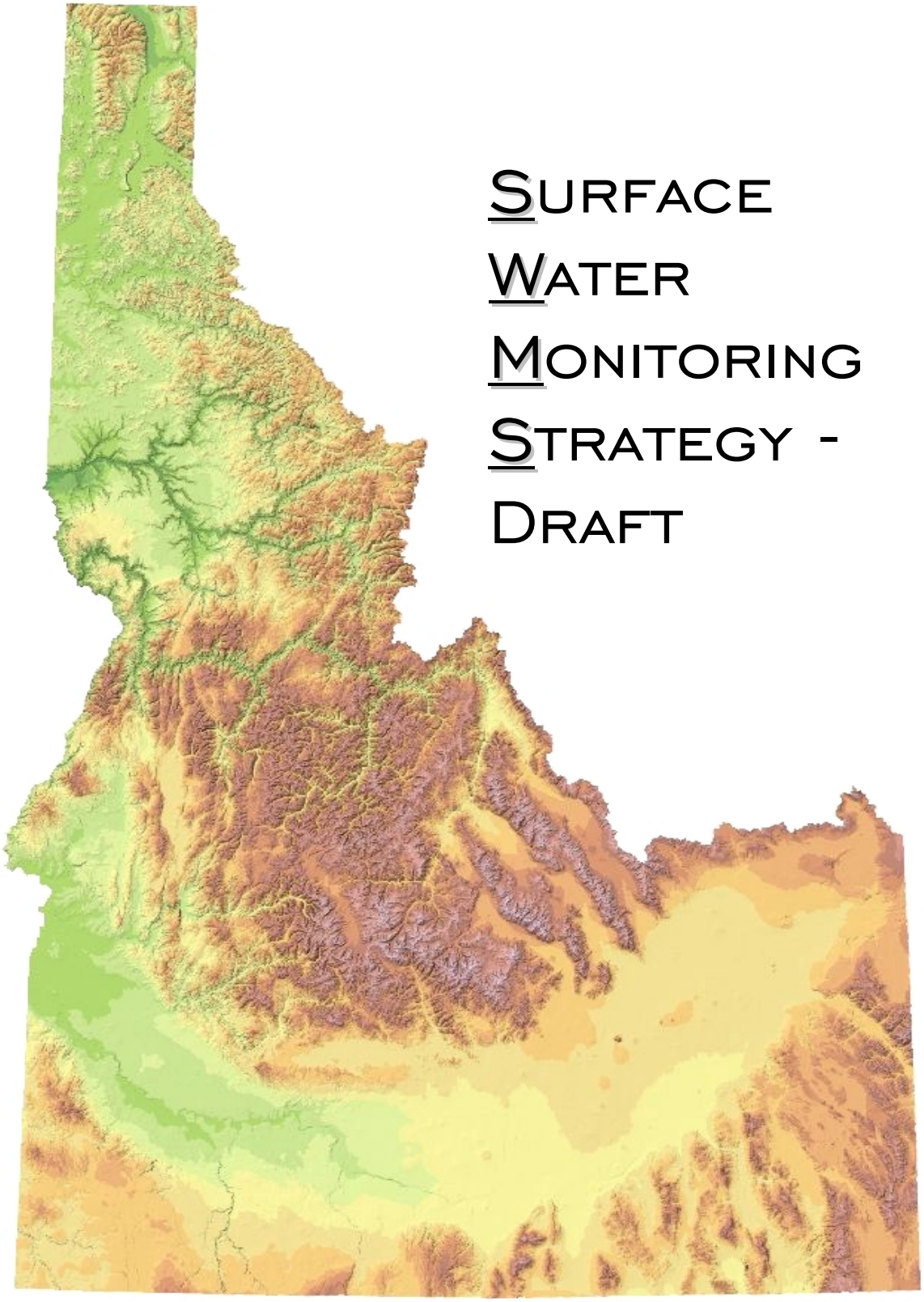

Surface Water Monitoring Strategy - Draft

Idaho Department of Environmental Quality

Surface Water Monitoring Strategy (Draft)

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Acronyms

Acronym	Explanation
ALUS	Aquatic Life Use Support
AU	Assessment Unit
BURP	Beneficial Use Reconnaissance Program
CALM	Consolidated Assessment and Listing Methodology
CWA	Clean Water Act
DEQ	Department of Environmental Quality
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
GAO	General Accounting Office
GIS	Geographic Information System
HUC	Hydrologic unit codes
NA	Not assessed
NAWQA	National Water Quality Assessment
NFS	Not fully supporting
NHD	National Hydrography Dataset
NRC	National Research Council
ORW	Outstanding Resource Water
QA	Quality assessment
QC	Quality control
RBP	Rapid Bioassessment Protocol
SWMS	Surface Water Monitoring Strategy
SWAMP	Surface Water Ambient Monitoring Plan
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WBAG	Water Body Assessment Guidance
WBID	Water Body Identification System
WQS	Water Quality Standard

Executive Summary

The Surface Water Monitoring Strategy (SWMS) is the overall, long-term strategy to streamline and integrate monitoring for different surface water programs. Embedded in SWMS are different monitoring plans including the Surface Water Ambient Monitoring Plan (SWAMP), a five-year ambient monitoring plan. SWMS provides the framework for collecting surface water data to meet Clean Water Act and agency goals. Specifically, ambient monitoring data is used to support the development of water quality criteria, report the condition of the state's waters, identify impaired waters, develop Total Maximum Daily Loads (TMDLs), implement best management practices, and determine the effectiveness of pollution control strategies.

This strategy design encompasses five-year ambient monitoring cycles, incorporating continuous feedback and refinement. Consequently, SWMS is a dynamic document, as are the associated monitoring plans. They will be adapted to meet new monitoring needs as changes occur in available resources, technology, agency priorities, and regulatory requirements.

Presently, SWMS is a proposed monitoring strategy undergoing public comment. Public feedback will be reviewed before finalizing and implementing SWMS.

GOALS

- Protect Idaho's water by using quality data in decision making
- Meet Clean Water Act requirements
- Streamline monitoring efforts and use resources efficiently
- Identify monitoring gaps and plan for program improvements
- Coordinate with other agencies and develop partnerships
- Inform Idaho citizens of monitoring plans and data results

OBJECTIVES

- Determine the condition of Idaho waters
- Determine which waters are impaired and require TMDLs
- Determine how and when waters will be remonitored
- Determine the condition of waters with insufficient data
- Identify the expectations (reference condition) for Idaho waters

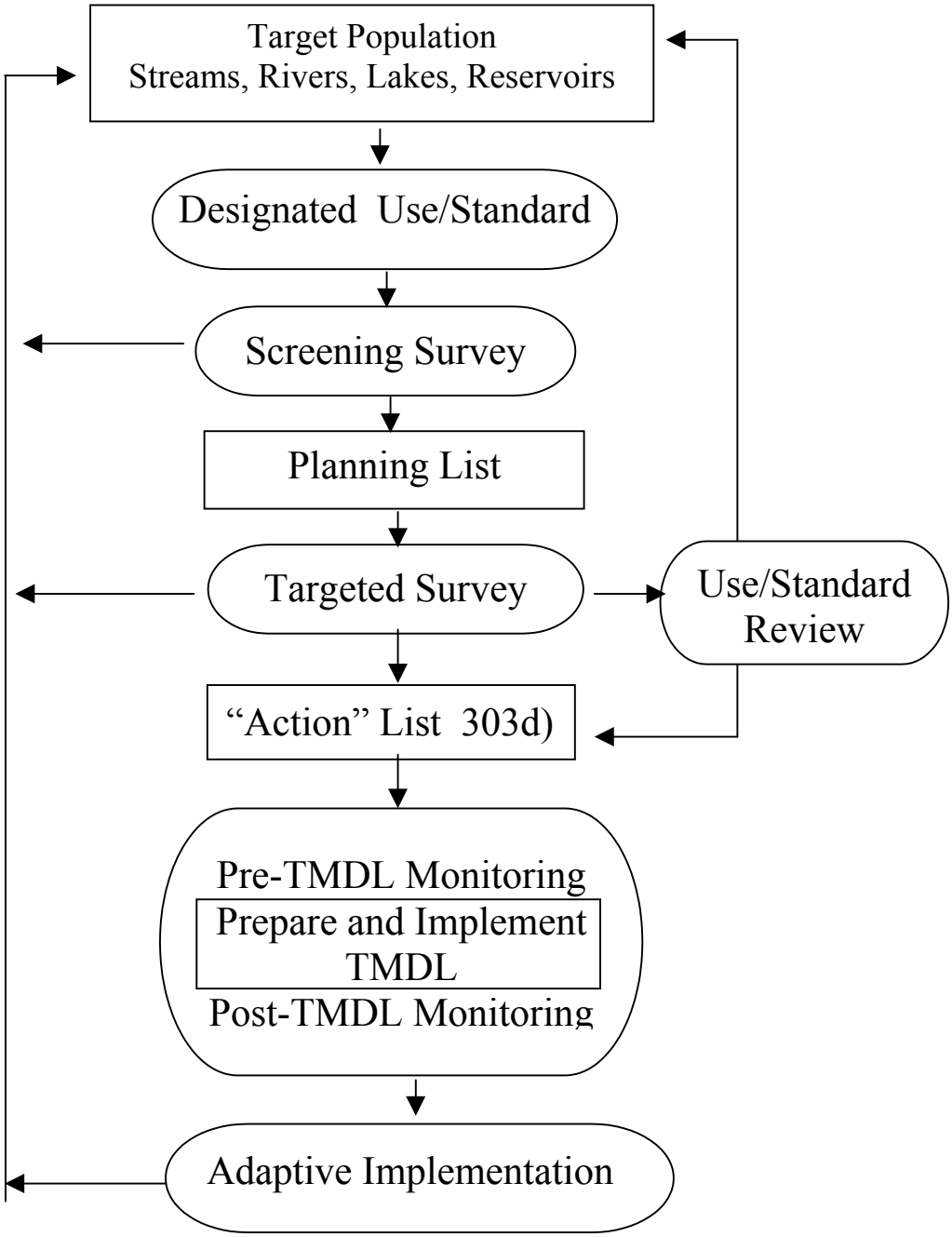
BASIS FOR CHANGES IN MONITORING STRATEGY

The monitoring strategy DEQ used before developing the SWMS would have censused all water bodies in Idaho. DEQ has found this approach impractical because of resource limitations. The SWMS provides for achieving the goals and objectives listed above without censusing. Additionally, the mismatch between monitoring requirements and available resources has long been recognized by other states, Congress, and U.S. Environmental Protection Agency (EPA). EPA and the National Resource Council (NRC) have made recommendations for dealing with this mismatch. DEQ recognizes the wisdom of the NRC and EPA recommendations and has developed the SWMS based on these proposals.

MAJOR ELEMENTS OF SWMS

This flowchart shows the major elements of the strategy, with each element described.

Overview of Monitoring Strategy



TARGET POPULATION

The cycle begins with defining the target population to monitor during the next five years. For the initial SWMS implementation, the target population is defined as perennial streams, rivers, lakes, and reservoirs.

DESIGNATED USES/STANDARDS

DEQ collects data that may be used to support designations, review current designations and standards, and prepare an integrated report describing support status of both designated and undesignated water bodies.

SCREENING SURVEY

This initial survey determines the overall condition of Idaho waters and identifies potential areas of impairment. For perennial streams and rivers, a weighted random design is used to select monitoring sites for this survey. DEQ will attempt to census approximately 100 lakes and reservoirs requiring screening visits. The survey screening will include monitoring of reference sites, benchmarks to evaluate other water bodies against. This monitoring will detect trends and identify natural variability in reference conditions. Sites to be included in the screening survey will be publicized, to encourage coordination and partnership with other agencies and monitoring parties.

PLANNING LIST

This is an intermediate step, before preparing the final 303(d) list (list of impaired water bodies). This list identifies areas of potential impairment and prioritizes them for targeted surveys. This intermediate step is recommended by the NRC, EPA, and other states.

TARGETED SURVEYS

Based on the planning list, targeted surveys attempt to determine the extent of impairment and generally identify the causes. Data from the BURP (Beneficial Use Reconnaissance Program) database is combined with a desktop exercise that identifies possible pollutants. If additional information is still needed, some basic monitoring could be performed to support this desktop exercise. This information will support only the preparation of the 303(d) list, not TMDL load allocations.

303(D) LIST

By the time this step is reached, DEQ should have sufficient data to prepare a prioritized list of impaired waters with causes generally identified. Specifically, DEQ can prepare the Integrated Report which describes the condition of Idaho waters, lists waters not meeting water quality standards (impaired waters), and identifies waters requiring TMDLs.

TMDLS

Pre-TMDL monitoring to support load determination and post-TMDL monitoring to determine effectiveness of TMDL control strategies are key to successful TMDL implementation. These types of monitoring efforts will be conducted separately from the ambient monitoring program, although resulting data is often integrated.

ADAPTIVE IMPLEMENTATION

Adaptive implementation entails continuously improving management practices based on new information and technology as it becomes available. This includes adjusting the plan when it's discovered that a water body has changed status with respect to whether it is meeting standards and attaining uses assigned to it.

PUBLIC PARTICIPATION

Public participation is a valuable and needed resource in SWMS. DEQ will communicate progress throughout the strategic steps and encourage monitoring coordination and partnerships.

Introduction

The Surface Water Monitoring Strategy (SWMS) is the Idaho Department of Environmental Quality's (DEQ) framework for collecting surface water data to meet Clean Water Act (CWA) and agency goals. Specifically, DEQ monitors to determine whether Idaho waters are supporting beneficial uses and assess whether control strategies are improving water quality. SWMS is the overall, long-term strategy to streamline and integrate monitoring for all the surface water programs. Embedded in SWMS are different monitoring plans including the Surface Water Ambient Monitoring Plan (SWAMP), a five-year ambient monitoring plan that supports development of the Integrated Report. The Integrated Report describes the condition of Idaho waters, lists waters not meeting water quality standards (impaired waters), and identifies waters requiring Total Maximum Daily Loads (TMDL). SWMS and associated monitoring plans are dynamic documents. They will be adapted to meet new monitoring needs as changes occur in available resources, technology, agency priorities, and regulatory requirements.

This document provides internal guidance to DEQ staff regarding monitoring objectives and priorities. Moreover, SWMS communicates DEQ's monitoring approach to other monitoring parties and the public. DEQ intends to improve communication of monitoring results, coordination with other monitoring agencies, and establishment of partnerships that result in efficient use of monitoring resources.

Presently, SWMS is a proposed monitoring strategy undergoing public comment. Public feedback will be reviewed before finalizing and implementing SWMS.

Background

CLEAN WATER ACT

In 1972, Congress passed Public Law 92-500, Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA). The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The federal government, through the U.S. Environmental Protection Agency (EPA), assumes the dominant role in defining and directing water pollution control programs across the country. DEQ implements the CWA in Idaho while the EPA provides oversight of Idaho's fulfillment of CWA requirements and responsibilities.

For the most part, SWMS addresses federal requirements found in Sections 303 and 305 of the CWA. The statutory and regulatory requirements differ significantly for 303 and 305 reporting. Section 303 requires DEQ to adopt water quality standards, with EPA approval, and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not supporting beneficial uses. For those waters not supporting their beneficial uses, DEQ prepares TMDLs for each pollutant impairing the waters. Based on this information, a collaboration of designated state and federal agencies set appropriate controls to improve water quality and permit the water bodies to meet their designated uses. Section 305 requires a description and analysis of the water quality condition of Idaho waters. "Condition" is defined as the extent to which state waters are meeting water quality

standards. Sections 303 and 305 requirements result in two primary reports: the Integrated Report and TMDLs.

Integrated Report [formerly 305(b) Report and 303(d) List]

Under Sections 303 and 305, DEQ describes the condition of Idaho waters and identifies water bodies not meeting water quality standards (impaired waters). Impaired waters in Category 5 require further analysis performed under a TMDL. Appendix A provides a description of the different reporting categories of the Integrated Report (Sutfin 2001).

TMDL

The TMDL is a plan to improve water quality by limiting pollutant loads. In Idaho, the TMDL consists of two main sections: the subbasin assessment and load allocation. The subbasin assessment uses monitoring data to evaluate and summarize current water quality status, pollutant sources, and control actions to date. The load allocation is an estimate of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). It includes individual pollutant allocations among various sources discharging the pollutant. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, and often incorporates TMDLs for several water bodies and/or pollutants within a given watershed.

Idaho water quality standards

Idaho adopts water quality standards to protect public health, enhance water quality, and protect biological integrity (These standards are found in Idaho's Water Quality Standards and Wastewater Treatment Requirements IDAPA 58.01.02.100[1] and can be viewed at http://www2.state.id.us/deq/rules/waterrul.htm). Among other things, a water quality standard defines the goals of a water body by designating uses for the water and setting criteria necessary to protect those uses.

In the Idaho water quality standards (WQS § 100-160), DEQ assigns or designates beneficial uses for particular Idaho water bodies to support. These uses may be assigned specifically to a water body (aquatic life, recreation, domestic water supply) or applied to all the state waters (agricultural and industrial water supply, wildlife habitat, and aesthetics).

Mission

DEQ's mission is "to protect human health and preserve the quality of Idaho's air, land and water for use and enjoyment today and in the future (DEQ 2001)." SWMS supports this mission by presenting a monitoring framework that bases DEQ surface water decisions on quality data. The data collected is appropriate for the questions being asked and assists DEQ in protecting Idaho's water. SWMS is also focused on building partnerships with federal agencies, other state agencies, the Tribes, communities and businesses. In this way, SWMS supports DEQ's vision to "assess, sustain, preserve, and enhance environmental qualities in

[1] Henceforth, subsections of Idaho Administrative Code within IDAPA 58.01.02 are abbreviated as "WQS.XXX" where XXX is the subsection. For example, "IDAPA 58.01.02.100" is abbreviated as "WQS § 100." Idaho statutes are referred to as "Idaho Code" and abbreviated "IC § 39-3601," for example.

partnership with communities and businesses, and in concert with the economic vitality of the state (DEQ 2001)."

Goals

PROTECT IDAHO'S WATER BY USING QUALITY DATA IN DECISION MAKING

One of DEQ's guiding principles is to "rely on science and common sense to guide decisions and achieve results (DEQ 2001)." SWMS is designed to collect quality data appropriate for questions being asked. For example, in making decisions concerning the status of Idaho's waters, DEQ uses data that is scientifically rigorous and relevant (see Appendix B or Section 4 in Grafe et al. 2002). DEQ uses Tier II and III data in other water quality decisions including monitoring planning. In this way, DEQ has greater confidence in water quality decisions.

MEET CLEAN WATER ACT REQUIREMENTS

The CWA, particularly sections 303 and 305 (b), is the guiding statute for DEQ's surface water monitoring program. DEQ collects scientifically defensible data to support the development of water quality criteria, report the condition of the state's waters, identify impaired waters, develop TMDLs, implement best management practices, and determine the effectiveness of pollution control strategies.

STREAMLINE MONITORING EFFORTS AND USE RESOURCES EFFICIENTLY

It is important that DEQ use its resources as efficiently as possible. By streamlining monitoring efforts, DEQ reduces duplications of effort, leverages its monitoring resources, and improves coordination of common monitoring goals.

IDENTIFY MONITORING GAPS AND PLAN FOR PROGRAM IMPROVEMENTS

Because of limited resources, DEQ must prioritize monitoring efforts and focus resources on top priorities. The result of this prioritization may lead to monitoring gaps or unanswered questions. The SWMS framework acknowledges these gaps and permits program expansion when resources become available. For example, DEQ has focused most of its ambient monitoring resources on developing a technically sound monitoring and assessment program for Idaho's streams and rivers. This is because most of Idaho's surface water, in general, is comprised of perennial streams and rivers. However, DEQ recognizes that other water body types such as intermittent streams, springs, and wetlands also require monitoring. DEQ plans to incorporate these waters into the monitoring program when resources are available.

COORDINATE WITH OTHER AGENCIES AND DEVELOP PARTNERSHIPS

An important way to use resources efficiently is to communicate with other monitoring groups and reduce duplication of data collection efforts. Since many Idaho agencies have common monitoring goals, coordination among these groups would greatly help all state and

federal monitoring efforts. Presently, there are several ways DEQ coordinates with other agencies and develops partnerships. The Beneficial Use Reconnaissance Program (BURP) coordinators participate in regional interagency monitoring meetings. These meetings are held around the state to exchange information regarding upcoming monitoring and discuss how to cooperate with different monitoring efforts. Another coordination tool is the Nonpoint Source Water Quality Results Monitoring Workshop. This workshop, started in 1991, assembles monitoring groups throughout Idaho to share monitoring results. The workshop provides an opportunity to interact with those in the monitoring field, improve consistency in monitoring methods, and build relationships for future coordination. Lastly, Clark (1990) prepared the *Coordinated Nonpoint Source Water Quality Monitoring Program for Idaho*. This document describes roles and responsibilities of different agencies to ensure monitoring goals are addressed.

In addition to these efforts, an important component of SWAMP is to notify interested parties exactly where DEQ will be conducting screening surveys. DEQ hopes this notification will create more opportunity for coordinating monitoring efforts and developing monitoring partnerships.

INFORM IDAHO CITIZENS OF MONITORING PLANS AND DATA RESULTS

One of DEQ's principal responsibilities is to inform Idaho citizens about water quality conditions. Not only is it important to report final monitoring results, but also to inform the public of monitoring progress and ensure understanding of how DEQ evaluates monitoring data to determine water quality condition. DEQ provides much of this information through the BURP Annual Workplan (DEQ 2002) and Water Body Assessment Guidance (Grafe et al. 2002). The BURP Annual Workplan provides information regarding DEQ's annual monitoring goals and specifics of the monitoring focus. The Water Body Assessment Guidance describes how DEQ assesses monitoring data to determine the status of water quality in Idaho. Both of these documents may be found at http://www2.state.id.us/deq/surface water. DEQ believes SWMS and SWAMP will improve public information regarding where DEQ intends to monitor.

Objectives

DEQ has very specific questions or objectives that shape the design of the monitoring strategy and plan.

DETERMINE THE CONDITION OF IDAHO WATERS

As mentioned earlier, one of DEQ's primary goals is to meet CWA requirements. An important CWA requirement is to report the condition of Idaho waters to EPA who incorporates this information into a national report for Congress. To ensure that Idaho data can be effectively used in a national report, DEQ reviewed other state monitoring programs (Oregon Water Quality Monitoring Team 2001, Ward 2001, South Carolina Department of Health and Environmental Control 2002, Biernacki 1999, North Carolina Department of Environment and Natural Resources 2000, CALM 2000, EMAP 2002, and NWQMC 2002) and EPA recommendations (Sutfin 2002). These states have turned to a random survey design to comprehensively answer questions concerning the condition of state waters. Determining the condition of Idaho waters requires a monitoring strategy that broadly addresses the entire state and different types of water bodies.

DETERMINE WHICH WATERS ARE IMPAIRED AND REQUIRE A TMDL

A more specific question is based on requirements for the 303(d) list and TMDL. The monitoring strategy must provide specific enough data to determine which waters in Idaho are impaired and whether there is a basis for requiring a TMDL for a specific water body. The strategy must also be capable of determining the extent of impairment so that DEQ can prepare TMDLs as efficiently as possible.

DETERMINE HOW AND WHEN WATERS WILL BE REMONITORED

Water quality conditions change as a result of best management practices, changes in human disturbance, and climatic events (e.g., floods, drought). Consequently, a monitoring program should evaluate the condition of the State's waters regularly. The cycle must be sufficiently short so that impaired water bodies are identified early enough to permit successful remediation, but long enough to allow for improvement of water quality due to pollution control strategies. A pre-determined monitoring cycle also assists in actively involving other monitoring entities and the public in DEQ's monitoring efforts. SWAMP will use a discrete five-year monitoring cycle.

DETERMINE THE CONDITION OF WATERS WITH INSUFFICIENT DATA

DEQ has found that one of the most efficient monitoring strategies to evaluate aquatic life is directly measuring the biological condition of the water body. Sometimes, however, biological monitoring results are inconclusive or additional data are required to identify the pollutant causing impairment. SWMS is designed to address these waters by collecting additional data through targeted surveys.

IDENTIFY THE EXPECTATIONS (REFERENCE CONDITION) FOR IDAHO WATERS

To assess water quality status, DEQ must use benchmarks or reference sites for comparison purposes. These reference sites set water quality expectations for different types of water bodies located in different regions of the state. For chemistry data, often there are numeric criteria that set the benchmark for water quality conditions. However, for biological and physical data, DEQ uses the biological condition of minimally disturbed water bodies to set the reference condition that other water bodies are then compared against. Under SWAMP, DEQ regularly monitors reference benchmarks to understand biological and physical changes due to natural conditions.

Current Ambient Monitoring Programs

Currently, DEQ performs annual water body monitoring based on agency priorities and available resources. BURP and the U.S. Geological Survey (USGS)/DEQ Trend Monitoring Network are DEQ's primary ambient monitoring programs. DEQ also performs specific monitoring to support the development of subbasin assessments/TMDLs and evaluate the effectiveness of implementation plans. These TMDL monitoring activities are often funded separately from DEQ's ambient monitoring programs described below.

BENEFICIAL USE RECONNAISSANCE PROGRAM (BURP)

In 1993, DEQ implemented BURP, an ambient monitoring program aimed at integrating biological and chemical monitoring with physical habitat assessment as a way of characterizing water quality and stream integrity (McIntyre 1993). BURP addresses small streams, large rivers, lakes and reservoirs and closely follows concepts and methods described in EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* developed (Barbour et al. 1999). BURP primarily provides consistency in ambient monitoring data and collects data for beneficial use support assessments. BURP uses a targeted monitoring design to answer specific questions regarding the condition of particular water bodies or small watersheds. DEQ specifically selects representative sites with the intent of assessing a broader geographic area. To ensure representativeness, DEQ considers land use, ecoregion, and stream order during site selection. These factors govern the extent a site represents a broader geographic area. Figure 1 illustrates the distribution of BURP sample sites (1993 – 2001).

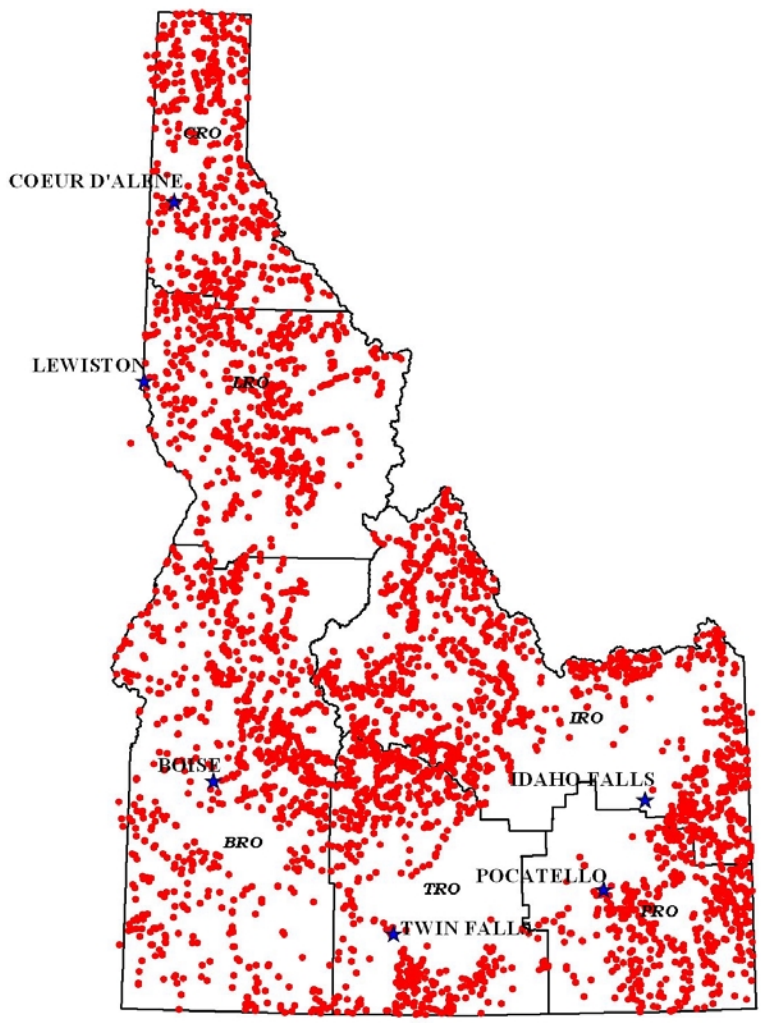


Figure 1. Distribution of BURP sample sites to date (1993 –2001).

DEQ publishes an annual work plan for statewide use by DEQ field crews as well as other entities. There are six regional BURP coordinators who train and direct crews, while the state office BURP coordinator and other staff audit crews to ensure consistent monitoring practices. The monitoring is conducted during the index period of July through September for streams and August through mid-October for rivers. Collected data are transmitted to the state office for quality assurance review and entry into a statewide BURP database. The quality assurance process follows the DEQ *Beneficial Use Reconnaissance Program Quality Assurance Plan for Field Data Sheets on Wadeable (Small) Streams* (DEQ 2001). DEQ is also participating in a five-year pilot study that started in 2000 to evaluate randomized sampling methods and EPA protocols (e.g., Environmental Monitoring and Assessment Program — EMAP). DEQ will continue to evaluate the feasibility of including some EMAP components into BURP.

USGS/DEQ TREND MONITORING NETWORK

In 1990 USGS, in cooperation with DEQ, implemented a statewide trend monitoring network. The objective was to provide water quality managers with a coordinated statewide program to detect trends in surface water quality. The USGS monitors 56 stations (see Figure 2) 40 of which are designated as biological sampling sites. To accommodate budget limitations, biological sites are divided among three geographic regions (southeastern, southwestern, and northern) and sampled once over a three-year rotation (O'Dell et al. 1998).

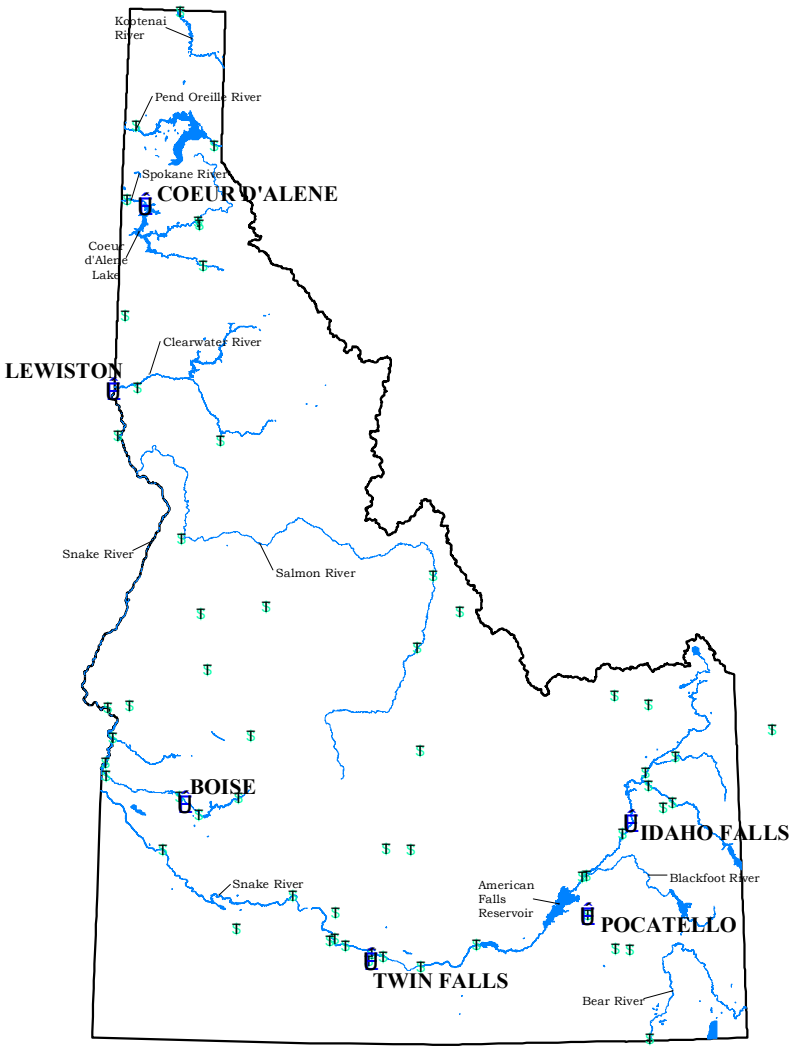


Figure 2. USGS/DEQ trend monitoring network consisting of 56 stations.

At these stations, water chemistry sampling occurs monthly during April through September and consists of discharge, specific conductance, pH, temperature, turbidity, dissolved oxygen, bacteria, nutrients, and suspended sediment. Temperature is recorded continuously during summer months (June to September) at sites where samples are collected for biological analyses. Major ions and alkalinity are sampled during base flow conditions in September. Biological sampling occurs during summer/fall low flow conditions and consists of macroinvertebrates, fish, and associated stream habitat parameters (O'Dell et al. 1998). USGS manages the trend monitoring data in their own database. The agency summarizes this data in official Survey reports and also provides the hydologic data on the web at http://idaho.usgs.gov/.

MONITORING DATA MANAGEMENT

All data collected under BURP are stored in a centralized database at the state office. Data for each sample site are recorded on standard field forms. Regional offices house original field

forms and send copies directly to the state office for quality assurance (QA) review prior to data entry. Regional offices also house other DEQ data collected to support subbasin assessments, TMDLs, and implementation plans. During the BURP QA process, the field forms are checked for completeness, legibility, and accuracy. Presently, DEQ does not manage data collected outside the Department.

Basis for Monitoring Strategy Changes

LIMITED RESOURCES VS. CURRENT CENSUS APPROACH

Public and private sectors understand that successful completion of desired goals requires operating according to priorities and within available resources. With changes in the economy, it is increasingly important to follow this principle. DEQ uses a strategy that meets numerous agency goals while allowing expansion or reduction in data collection based on available resources.

BURP currently attempts to representatively sample every stream in Idaho. This census approach of all perennial streams (based on a 1:100,000 scale) in Idaho has proven to be unacceptably expensive and time consuming. From 1993 through 2001, DEQ sampled over 4,000 sites. These sites represent about 2,500 water body identification units (WBID) and 4,700 assessment units (AU). A WBID usually represents a small watershed and is used in Idaho's water quality standards to geo-locate waters in the state. The scale of a WBID is generally comparable to a 6th -field (12 digit HUC code) watershed although some may be larger or smaller. The AU is a mechanism to group waters, within a WBID, into a meaningful unit for assessment purposes. Presently, most AUs are grouped based on stream order and land use; however DEQ assessors have the option to further delineate AUs based on additional information. Therefore, the number of WBIDs in Idaho is presently a fixed total, whereas the total number of AUs will continue to change based on current and future assessment decisions. Figure 3 illustrates the scale differences among HUCs, WBIDs and AUs.

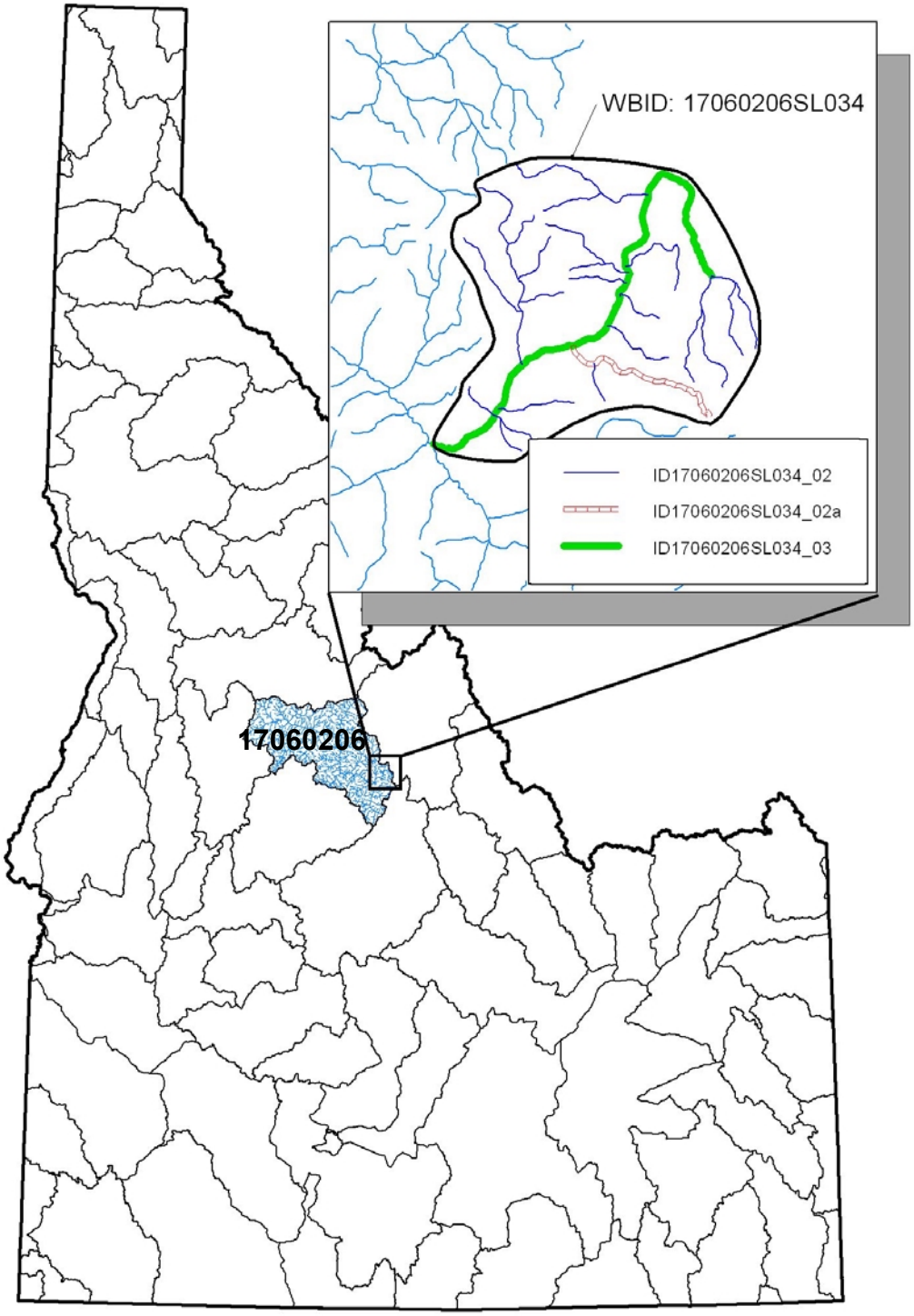


Figure 3. Example of the scale differences for DEQ's reporting units. WBIDs (17060206SL034) are located within HUCs (17060206); assessment units (17060206SL034_02, _02a, _03) are contained within WBIDs.

With this in mind, DEQ estimates that seven years of monitoring has resulted in censusing 60% of Idaho's perennial streams. It should be noted that DEQ's monitoring activity has been reduced dramatically in the past three years due to increases in sample and labor cost. This has resulted in an annual reduction of over 400 monitoring sites. Consequently, the census coverage of Idaho waters would be an even lower percentage at DEQ's current monitoring production.

It is evident that a census of AUs rather than individual streams is also unacceptable. Based on current information regarding labor and sample cost, DEQ estimates that placing just one monitoring site per AU would require about 12 years of monitoring which does not meet DEQ's goal to operate within five-year monitoring cycles. Further, this one site would likely not be representative of the entire AU or even all the different types of water bodies in that watershed (e.g., lakes, large rivers). Additionally, if all the ambient resources were devoted to this type of census approach, then other monitoring goals likely would not be reached. For example, it would be difficult to determine the extent of impairment to support 303(d) listings and eventual TMDL development. Also, DEQ would require other resources to address repeat sampling and reference trend monitoring objectives.

NATIONAL CHANGES

States, Congress and EPA have long recognized that monitoring requirements and available resources are often mismatched. The General Accounting Office (GAO 2002) reported that inconsistent data collection and assessment methods among the states have complicated efforts to identify the nation's polluted waters. The National Research Council (NRC 2001) recommended a strategy that would allow states to report the condition of state waters, identify impaired waters and develop scientifically sound TMDLs within a limited resource budget. EPA is recommending a similar approach that incorporates integrated reporting requirements (Brown 2002). Appendix C illustrates how EPA envisions a monitoring strategy similar to DEQ's that meets integrated reporting requirements. Further, EPA has increased its technical support to assist states in developing scientifically sound monitoring designs to address CWA requirements. DEQ recognizes the wisdom of the NRC and EPA recommendations and has developed SWMS based on these proposals.

Data Requirements

DEQ designs monitoring surveys to collect data appropriate for the question being asked. For instance, "what is the condition of Idaho waters?" is a broad question requiring a survey design that interprets data from sample sites to determine statewide conditions. A random survey design in which monitoring sites have an equal chance of selection is appropriate for this type of question. Most election polls use a similar survey design.

The 303(d) list requires more focused data. In this case, DEQ must confirm impaired waters and determine the extent of impairment. The appropriate survey design in this situation uses a combination of random and targeted designs. The randomly selected sites define the extent of impairment while targeted sites are chosen for their locations near likely sources of impairment.

By the time the TMDL process starts, DEQ should have a clear picture of which waters are impaired and a general idea of the causes. The pre-TMDL monitoring (which is separate from

the ambient monitoring) refines pollutant identification and is the basis for load allocation. A targeted design requiring more intensive sampling is appropriate in this case. Post-TMDL monitoring determines whether the TMDL is effective in reducing pollutants and there is an upward trend in meets water quality. This type of monitoring also requires a targeted approach although a few random sites throughout the watershed may be appropriate. Table 1 summarizes the data requirements and appropriate sampling designs.

Table 1. Summary of data requirements.

Product	*Question*	*Data Requirements*	*Survey Design*
305(b)/ Integrated Report	What is the condition of Idaho waters?	Obtain representative data of the entire target population.	Random (with weighting factors)
303(d)/ Integrated Report	Which waters are impaired and require a TMDL?	Confirm impairment and determine extent throughout watershed(s).	Random/ Targeted
TMDL (Pre-)	What is(are) the pollutant(s) causing impairment? What is the load allocation?	Confirm causes and sources. Determine pollutant loads for allocation purposes.	Targeted Intensive Survey
TMDL (Post-)	Is the water body(ies) or watershed meeting water quality standards?	Confirm reduction of pollutant loads and improvement of water quality.	Targeted Trend Random (some)

Strategy Constraints

In developing SWMS, DEQ placed several constraints on the framework. Changes in resources or monitoring priorities may place additional constraints beyond those listed below.

DISTRIBUTE MONITORING RESOURCES AMONGTHE SIX DEQ REGIONS ANNUALLY

DEQ wishes to continue implementing BURP monitoring out of each regional office annually to ensure resources are adequately distributed among the regions. Figure 4 points out the geographical boundaries of DEQ's six regional offices.

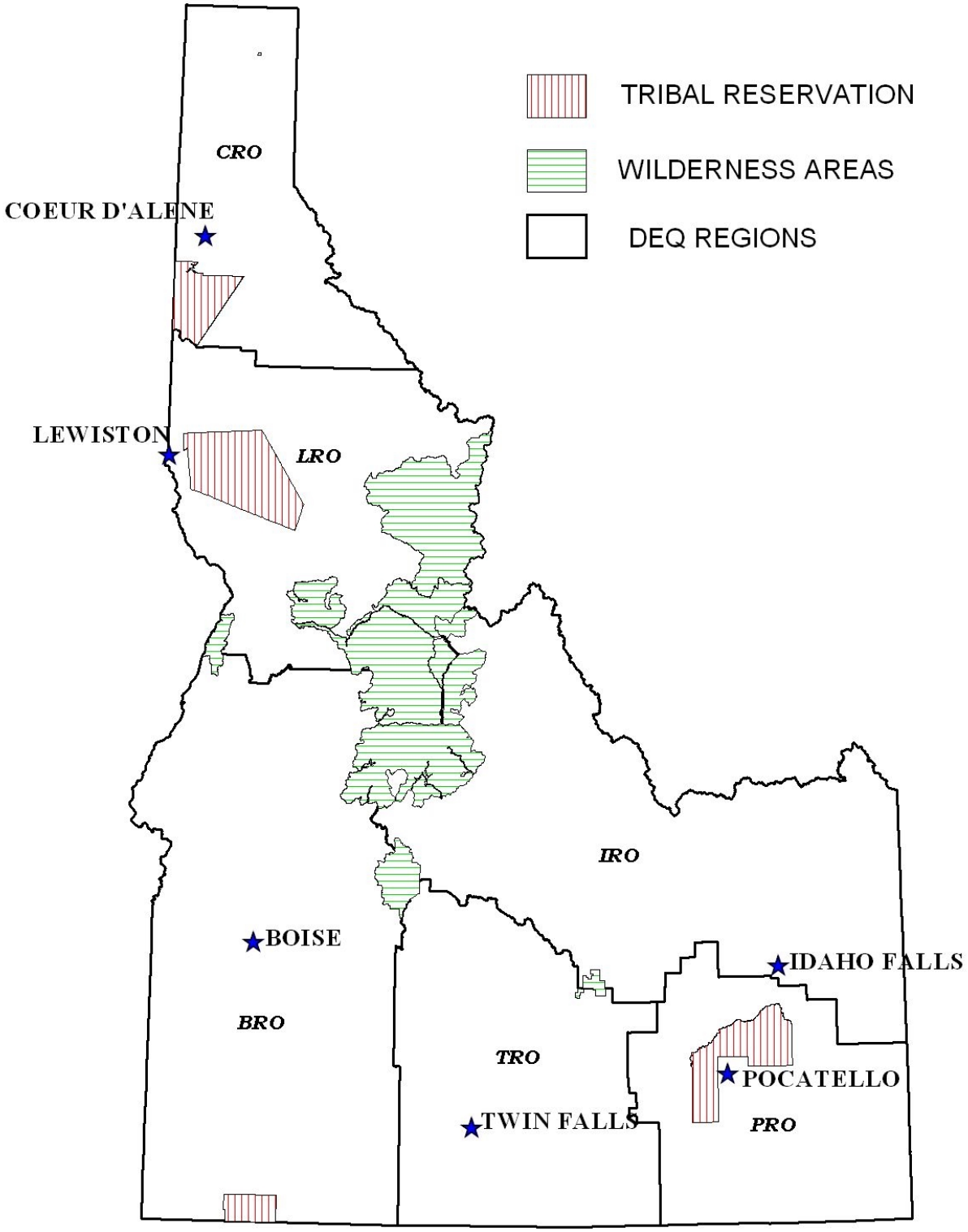


Figure 4. DEQ regional, Tribal reservation, and wilderness boundaries.

AMBIENT MONITORING CYCLE WILL BE FIVE YEARS

DEQ believes a five-year monitoring cycle is appropriate for several reasons. First, DEQ policy determines data that is five years old or newer to be Tier I data. Tier I data is used for a variety of purposes including 303(d) listing decisions, 305(b) reporting, subbasin assessments, TMDLs, and planning for future monitoring (see Section 4 in Grafe et al. 2002 and Appendix B). Consequently, DEQ relies most heavily on data that is five years old or newer. However, DEQ uses Tier II and III data for other water quality management decisions including monitoring planning. Second, EPA recommends a five-year monitoring cycle (Sutfin 2001) and has directed such a cycle in the draft Consolidated Listing and Assessment Methodology Guidance (CALM 2000). Finally, many other states use a five-year monitoring cycle. Consequently, Idaho's monitoring cycle would be consistent with other state and national goals resulting in monitoring data more likely to comply with EPA requirements.

AMBIENT MONITORING WILL NOT OCCUR WITHIN TRIBAL RESERVATION OR WILDERNESS BOUNDARIES

Monitoring within wilderness boundaries can be resource intensive in terms of time and funding. In 2000 and 2001, DEQ performed a monitoring pilot to gather data in the Selway and Middle Fork of the Salmon tributaries and rivers. One of the pilot's primary purposes was to collect baseline data for developing stream and river reference condition, however, DEQ was also interested in the resources required to implement wilderness monitoring. DEQ determined that this type of monitoring could not be supported annually out of current BURP funding and would require special project funding for any future implementation.

There are several Tribal reservations in Idaho (see Figure 4). DEQ will look for opportunities to coordinate with the Tribes concerning monitoring plans and determine how to efficiently monitor so common Tribal and state goals are efficiently reached. An example is DEQ's coordination with the Nez Perce Tribe. The Nez Perce Tribe intends to implement a probability design to address ambient monitoring within reservation boundaries (Davis, personal communication). DEQ in cooperation with EPA is providing training on monitoring techniques (EMAP training, Boise, Idaho, 2001 and 2002) to assist the Tribe in gathering data that will meet their monitoring goals and may be used in DEQ assessment reports.

AMBIENT MONITORING WILL OPERATE WITHIN CURRENT RESOURCES

SWMS and SWAMP are designed to allow full implementation within DEQ's current budget. If additional resources become available, DEQ intends to expand them to include more sites and different types of water bodies. To estimate the number of sites that will be monitored under SWAMP, DEQ provides a monitoring and budget forecast in Appendix D based on historical cost and funding increases.

SWMS Overview

SWMS addresses monitoring goals and objectives through a systematic framework recommended by NRC (2001) and EPA (2002). Figure 5 illustrates the steps of SWMS. The strategy starts with defining the target population and reviewing designated uses, then DEQ conducts a broad screening survey that provides comprehensive general information needed to determine the condition of Idaho waters. As one moves through the strategy, more specific data is gathered to answer more detailed questions concerning water quality. Furthermore, the

strategy starts with a cost-effective screening survey and then requires more resources as DEQ targets monitoring efforts with greater certainty. Embedded throughout this strategy is SWAMP, designed to complete all the phases from the screening survey to the 303(d) "Action List" within a five-year cycle. DEQ will set objectives for the next five-year planning cycle during Year 4 of any current cycle. During this time, DEQ will review results from the current cycle, agency priorities, and available resources to design the next screening survey. The following descriptions explain each step of the process.

Overview of Monitoring Strategy

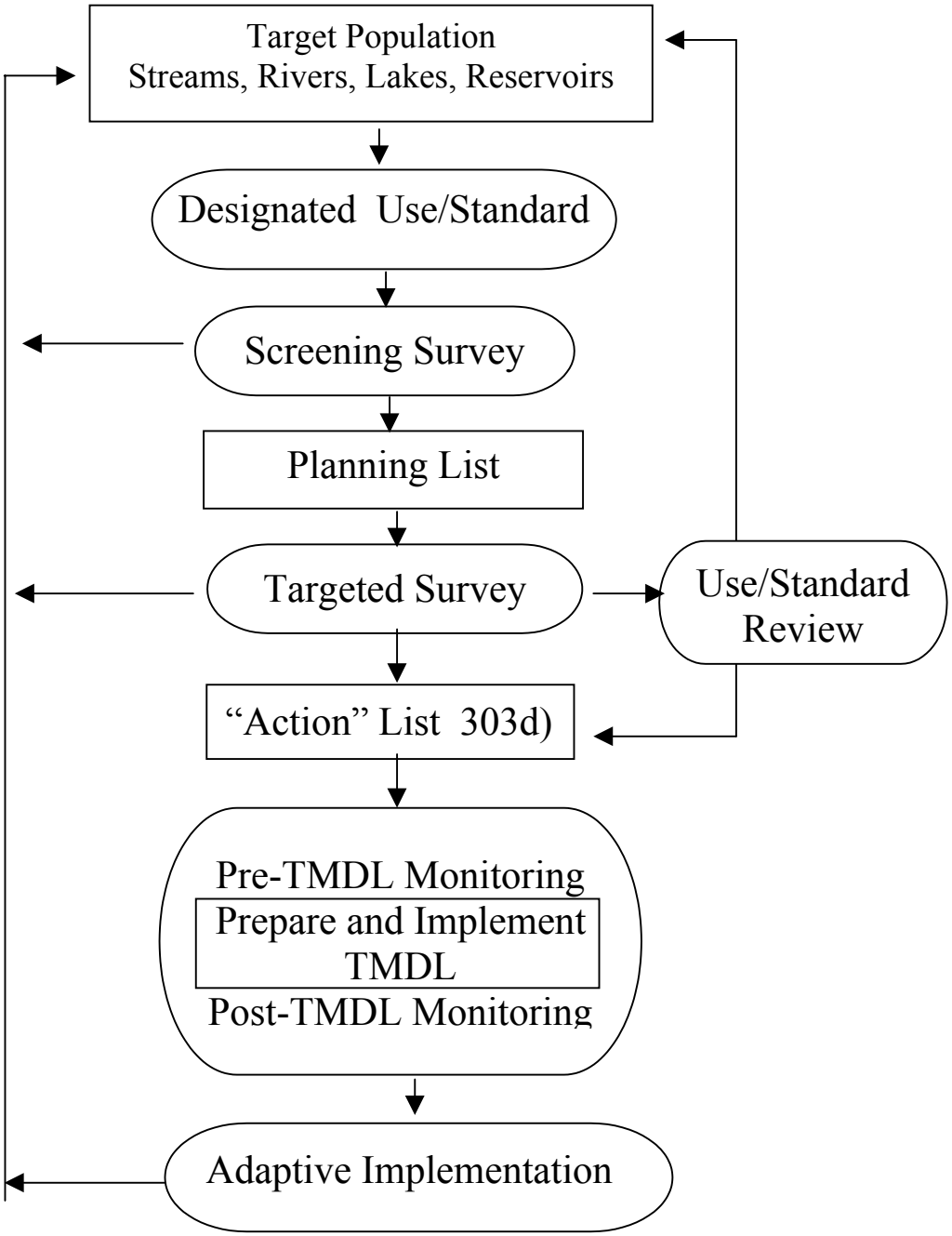


Figure 5. Overview of SWMS and SWAMP steps.
The figure illustrates relationships among surface water programs.

TARGET POPULATION

By defining the target population (waters to be sampled), DEQ builds a sampling design that focuses resources appropriately and cost-effectively. Presently, DEQ defines the target population for SWMS as perennial streams, rivers, lakes, and reservoirs. Because a majority of the state's waters consist of these types of water bodies, DEQ has focused on developing monitoring and assessment methods for these water body types first. If more resources are available, DEQ may expand the target population to other water body types (e.g., wetlands, intermittent streams, springs). Therefore, in SWMS and SWAMP, "Idaho's waters" are synonymous with the current definition of the target population.

DEQ uses the National Hydrography Dataset (NHD) as its georeferencing system to define the state's waters. The NHD is expected to change from a 1:100,000 scale to a finer resolution of 1:24,000. Because SWMS incorporates a statistical probability design, the scale changes to NHD should easily be incorporated into SWAMP.

DESIGNATED USES/ STANDARDS

The SWMS framework applies to designated and undesignated water bodies. Ideally, the monitoring strategy should identify designated uses first to design data collection needs. Considerable resources are required to designate or categorize every water body prior to monitoring and assessment. Consequently, DEQ collects data that may be used to support designations, review current designated uses and water quality standards, and prepare an integrated report of the support status of both designated and undesignated water bodies. Because DEQ is using a random design framework, the data collected may also be used to make general statements (e.g., percent stream miles supporting cold water aquatic life) regarding water quality and different beneficial use categories.

SCREENING SURVEY

Perennial streams

The purpose of the screening survey is to determine the overall condition of Idaho waters and identify potential areas of impairment. The screening survey uses a probabilistic design to select monitoring sites statewide. For perennial streams, DEQ ensures that a representative sample of different stream orders and geographical areas is taken by using a weighted approach.

To illustrate the weighted random design, DEQ performed two site selections. The simple random design had no weighting factors whereas the weighted random design was to distribute sites among stream orders. Figure 6 uses one watershed to illustrate the differences between using a simple random design and a weighted random design. As seen in the example, the simple random design results in most of the site selections occurring on 1st and 2nd order streams. Whereas the weighted random design is structured to distribute a more equal number of sites among the different stream orders. Table 2 summarizes the results of stream order differences in the two probability designs for the entire statewide site selection.

For the weighted random design, DEQ will likely consider distributing sites among other selection criteria including three main bioregions: (1) northern mountains, (2) central and southern mountains, and (3) basins (for more information regarding the grouping of ecoregions into bioregions see Grafe et al. 2002). The sites selected in the example were for

illustrative purposes only. Actual site selection will occur after the public comment is considered and the SWMS and SWAMP are finalized.

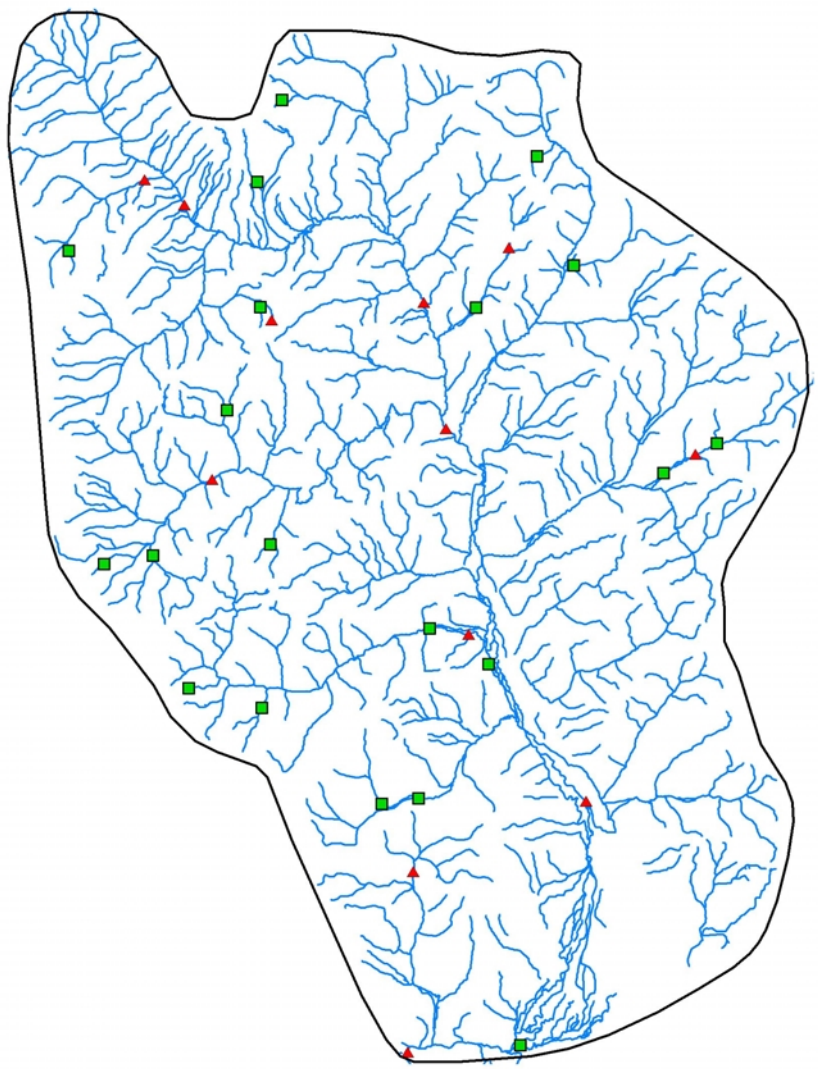


Figure 6. Example of site selections based on simple random and weighted random designs.

The squares denote monitoring points in the simple random design while the triangles illustrate monitoring points in the weighted random design. Note that the majority of the squares (the simple random design) fall on 1st and 2nd order streams.

Table 2. Summary of site selection differences for stream order based on the random versus weighted designs.

Stream Order	Random Design		Weighted Design	
	Total Sites Selected	% of Total	Total Sites Selected	% of Total
1-2	524	71%	183	25%
3	96	13%	183	25%
4	64	9%	182	25%
5+	51	7%	187	25%

Based on current resources, 735 screening sites on perennial streams would be sampled over a two to three year period. The year in which the sites are sampled will occur according to their location in different watersheds. To use monitoring resources efficiently, each region will likely sample all pre-selected sites occurring within a particular watershed and then rotate to the next watershed. In this way, the screening survey is a probablilistic rotating watershed approach occurring in each DEQ region. This rotating approach will simplify logistics, generate more detailed targeted surveys, and allow water quality status reporting of large watersheds.

The screening survey step also identifies third party data and uses predictive modeling to identify potential areas of impairment. As mentioned previously, DEQ hopes to use its resources as efficiently as possible to answer several water quality questions. Partnering with other entities to obtain quality data and using predictive models is key to the success of the screening survey in guiding resources to water quality impaired areas.

Large rivers, lakes and reservoirs

For rivers, lakes and reservoirs, DEQ will use a slightly different approach from the perennial streams for two reasons. First, there are fewer large rivers, lakes and reservoirs than perennial streams resulting in fewer resource requirements. Second, DEQ presently has been monitoring these water body types using one crew working out of the state office. Because one crew must travel statewide to monitor these water bodies, it is important to reduce travel time and simplify logistics to increase cost-effectiveness. Therefore, DEQ presently distributes seven crews, one to each of the six regional offices and one to the state office. Presently, the one state office crew must monitor large rivers and lakes/reservoirs. To ensure these water bodies are monitored regularly and efficiently, the state office crew will alternate monitoring of lakes/reservoirs and large rivers annually.

It is estimated that approximately 100 lakes and reservoirs will require screening visits. Since there are so few of these water body types, DEQ will attempt to census all these lakes and reservoirs for the screening surveys. In each lake or reservoir, DEQ will choose a site that represents the deepest portion of the lake or reservoir.

Presently, DEQ is conducting a pilot study for large rivers. The study is funded by EPA and uses EPA protocols (EMAP 2002) to determine if DEQ can adequately characterize the condition of large rivers within a three-year cycle. The study includes monitoring approximately 20 sites per year, including reference sites, in each bioregion (northern

mountains, central and southern mountains, and basins). The river sites will be sampled on a rotating geographical basis according to the three main bioregions: northern mountains, central and southern mountains, and basins. Consequently, a total of 60 sites will be monitored at the end of the three-year study. DEQ is budgeting (see Appendix D) 40 monitoring sites per bioregion which would total 120 sites for the three bioregions. In contrast to lakes and reservoirs, DEQ will not attempt to census large rivers, but instead will use a similar probabilistic approach to that used for perennial streams. DEQ differentiates between small streams and large rivers using three criteria: stream order, average width, and average depth. Section 2 of Grafe et al. (2002) provides more information regarding water body size criteria.

Reference trend monitoring

One of DEQ's objectives is to identify benchmarks or reference condition using minimally disturbed water bodies. This allows DEQ to make comparisons to determine if water bodies are water quality impaired or not. DEQ used hundreds of reference sites to develop multimetric indices for assessment purposes (Grafe a and b 2002). However, DEQ also wants to determine if there are any significant biological or physical changes to reference condition due to natural changes (e.g., drought, floods, wildfires). To detect trends and natural variability, DEQ monitors approximately 20 selected reference sites statewide.

Repeat sampling

Repeat sampling assists in quality assurance of data collection methods and determination of data result variability. DEQ will annually resample 10% of the screening survey sites. The resampling will occur among sites sampled within the index period and previous years to answer different questions concerning index period and interannual variability.

Publication of site selection

DEQ intends to publicize screening survey sites and schedules to encourage monitoring coordination and partnerships with other agencies. DEQ also plans to meet with other monitoring parties regularly to encourage supplementation of the screening and targeted survey efforts.

PRIORITIZED PLANNING LIST

Although data collected from randomly selected sites are sufficient to address DEQ's question regarding the condition of Idaho's waters [i.e., 305 (b)], these data are inadequate to determine the extent of impaired waters requiring TMDLs. With this in mind, DEQ takes an intermediate step before preparing the 303(d) list. This step is to prepare a planning list identifying areas of potential impairment and prioritizing those areas for further monitoring and data collection. Specifically, this planning list will be used to direct targeted surveys, determine the extent of impairment of priority areas, and generally determine the pollutant(s) causing impairment. This intermediate step is recommended by NRC, EPA, and other states (NRC 2001, EPA 2002, Hand et al. 2002).

As mentioned in the screening survey discussion, DEQ would not only use information from screening sites, but also third party data and predictive modeling results to develop the planning list. Based on the available data, DEQ would prioritize this list and then plan targeted surveys based on available resources. Figures 7 and 8 provide examples of how DEQ

might transition from the screening survey to the targeted survey using the planning list. Areas that are lower priority and are not identified for target surveys would be placed in Category 3 of the 303(d) list. This category lists waters with insufficient data. In the next planning cycle, DEQ would place a priority on surveying a proportion of these waters in the screening survey using the weighted random design approach.

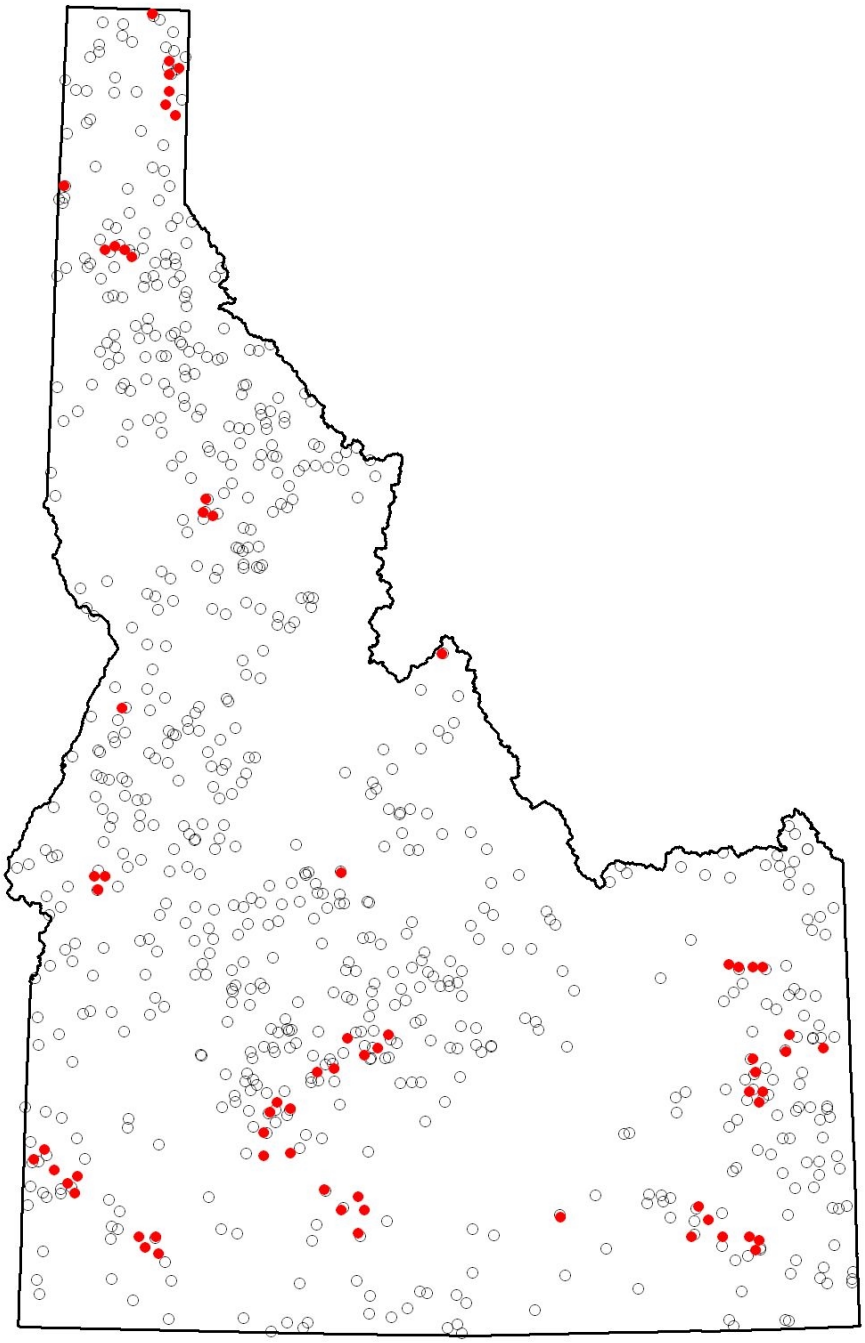


Figure 7. Example of potentially impaired sites as a result of a screening survey. Solid circles are visited sites where potential impairment was indicated.

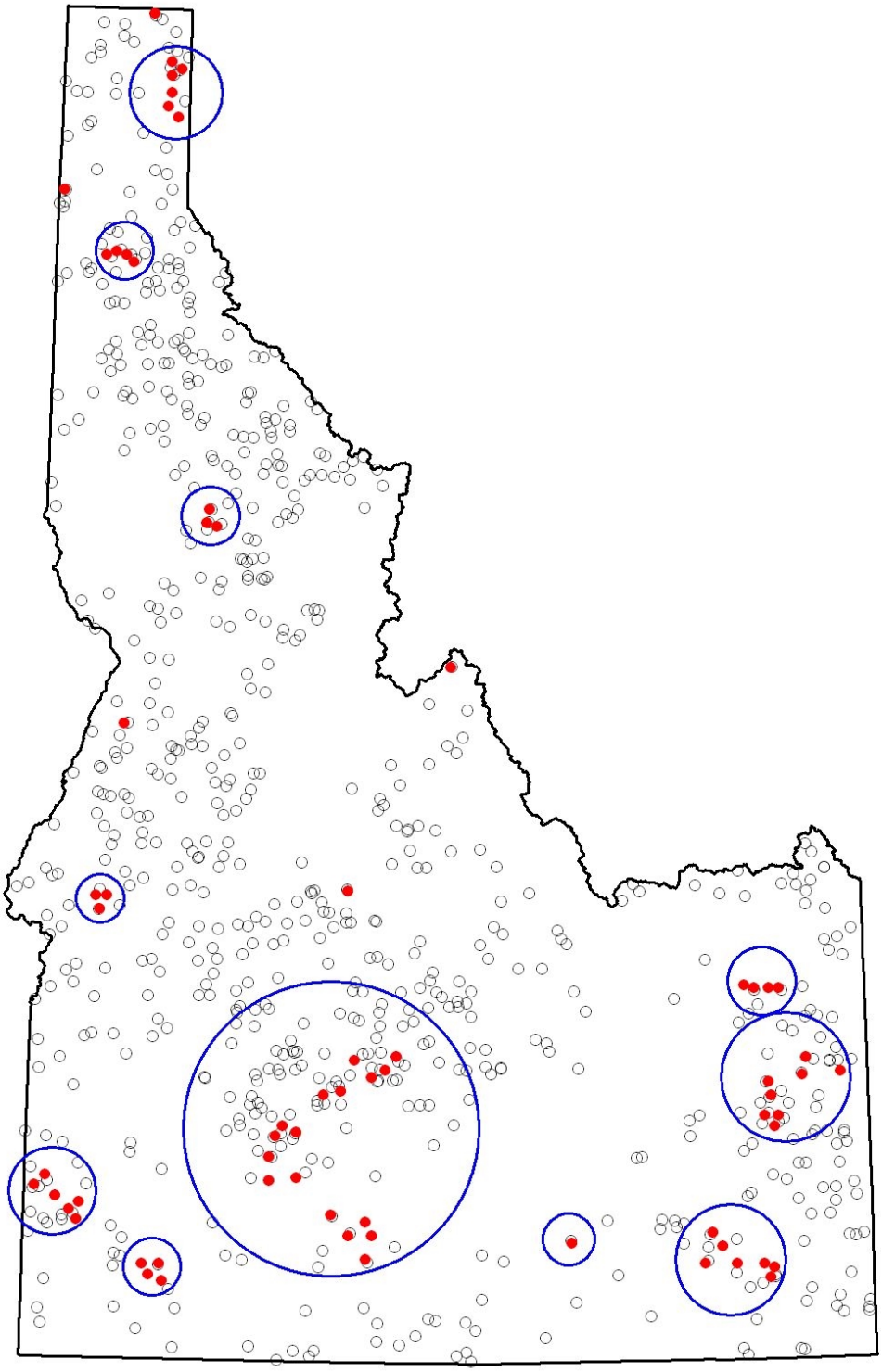


Figure 8. Example of focus areas for targeted surveys. Focus areas are based on a combination of screening visits, predictive modeling, and third party data.

Such a planning list is an important communication tool for the public, interested parities, and our monitoring partners. The list communicates how DEQ and its monitoring partners are progressing through the monitoring plan. The planning list also provides an opportunity for stakeholders to provide additional data or take management steps to prevent waters from being listed on the 303(d) "Action List".

TARGETED SURVEYS

Targeted survey areas are areas of potential impairment that have been given a high priority based on screening survey results, third party data, and predictive modeling. The purpose of a targeted survey is to determine the extent of impairment and generally identify the causes. Based on the prioritized planning list and available resources, DEQ focuses monitoring in areas where the suspicion of impairment is strongest. As explained earlier, DEQ uses biological and physical data to identify general water quality impairment. This data may not provide conclusive evidence of the actual cause of impairment. Therefore, in addition to the BURP monitoring, DEQ will initially perform a desktop exercise to identify possible pollutants. DEQ will use the Stressor Identification Guidance Document (Cormier et al. 2000) to eliminate unlikely pollutant candidates (see Appendix E). This logical process of elimination entails first listing candidate causes for the impairment. The next step is to analyze new and previously existing data to provide evidence. Then, DEQ would use this evidence to determine the most likely stressors causing the impairment.

After performing this desktop exercise, DEQ will determine if additional data collection is necessary to identify pollutants for the 303(d) list. If so, then DEQ would do some basic monitoring to identify pollutants. Examples of this would include data collection for E. coli bacteria, nutrients, sediment, and temperature. These are the significant pollutants found on DEQ's 303(d) list (DEQ 1998). It is important to note that this basic data collection would only identify the likely cause of impairment and would not be sufficient in developing TMDL allocations. Pre-TMDL monitoring is still necessary to develop load allocations. Also, DEQ does not anticipate additional significant resources directed toward this basic data collection. The intent is to provide additional support to the desktop exercise, if necessary, and to generally identify causes without addressing loads.

ACTION LIST [303(D)]

By the time this step is reached, DEQ should possess sufficient data to prepare a prioritized list of impaired waters with causes generally identified. The planning list along with more targeted surveys will assist DEQ in making decisions with more certainty and directing resources to priority areas. Targeted surveys also identify the extent of impairment and therefore allow DEQ to aggregate WBIDs or watersheds into sensible TMDL units. Such aggregation is essential for TMDL planning purposes and for efficient use of resources. Further, this strategy is expected to reduce the need for the delisting process that often occurs in the subbasin assessment phase of the TMDL. Again, based on this process, DEQ should be more certain that 303(d) listed waters identified through this process are actually impaired. Lastly, this strategy allows DEQ to prepare an integrated report that meets 305(b) and 303(d) reporting requirements. Appendix A describes the different reporting categories that DEQ would use through this strategy.

TMDLS AND ADAPTIVE IMPLEMENTATION

Pre-TMDL monitoring to support load determination and post-TMDL monitoring to determine TMDL effectiveness are key to successful TMDL implementation. Funding for these monitoring efforts is separate from the ambient monitoring program. Using SWMS and SWAMP, DEQ anticipates resources for pre-TMDL monitoring will be more efficiently focused upon load allocation rather than past efforts in the TMDL subbasin assessment phase to evaluate waters for delisting, identify pollutants, and evaluate the extent of impairment in a watershed.

Adaptive implementation entails continuously improving management practices based on new information and technology. NRC (2001) recommends using the monitoring strategy to provide ongoing feedback to different surface water programs, particularly review of water quality standards. Adaptive implementation incorporates short-term and long-term actions to improve water quality. After a reasonable period, the entity responsible for monitoring would then survey these waters to determine the response in the water body or biological condition. Once the water body is meeting its designated use(s), it is moved from Categories 4 or 5 of the integrated reporting list to Categories 1 or 2 and continues to be monitored through DEQ's screening survey design. Figure 9 illustrates the conceptual basis of adaptive implementation (NRC 2001). Similar to pre- TMDL monitoring, implementation monitoring is funded separately from the ambient monitoring program.

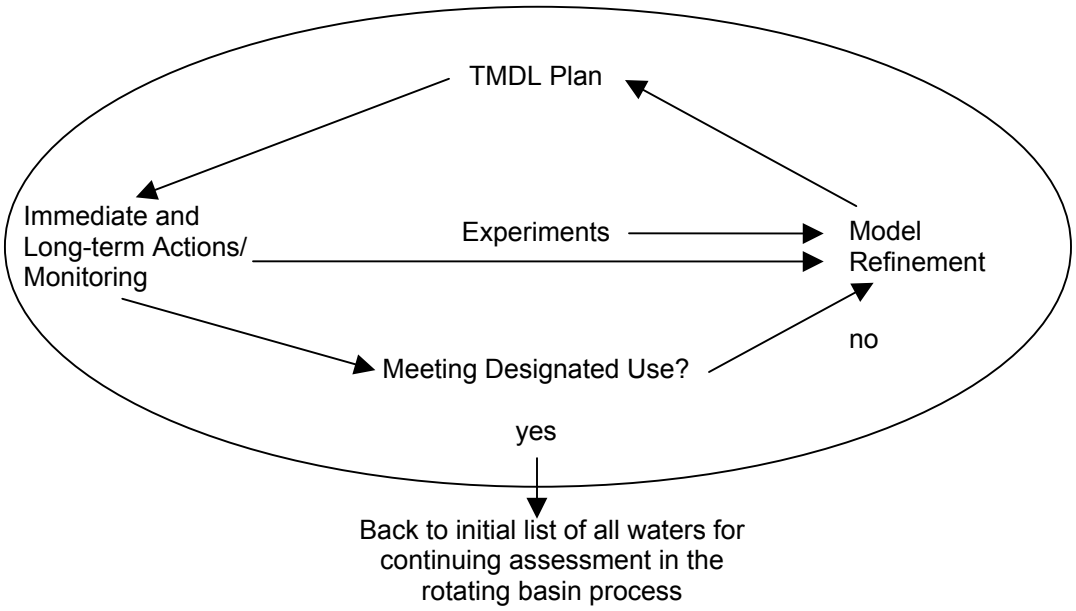


Figure 9. Illustration of the adaptive implementation process (NRC 2001).

PUBLIC PARTICIPATION

Public participation is a valuable and needed resource in SWMS and SWAMP. DEQ will communicate progress throughout the strategic steps and encourage monitoring coordination and partnerships. DEQ appreciates informal feedback at any time. More formal comment will

be possible during public comment periods for scheduled Integrated Reports and individual subbasin assessments/TMDLs. The public may provide comments concerning water body assessments and 303(d) “Action List” priorities at these times. In general, the DEQ state office manages all public comments associated with the Integrated Report while appropriate regional offices handle comments concerning particular subbasin assessments/TMDLs.

Glossary

Note: This glossary is intended to define terms within the context of the SWMS. Unless otherwise cited, these working definitions were prepared by DEQ.

Term	Definition
305(b)	Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which EPA, congress, and the public evaluate whether US waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Section 303 subsection "d" of the Clean Water Act. 303(d) requires state to develop a list of water bodies that do not meet water quality standards. This section further requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to EPA approval.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Aquatic	Pertaining to water. In this context, usually refers to plants or animal life living in, growing in, or adapted to water.
Beneficial use	Any of the various uses of water, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.
Beneficial Use Reconnaissance Program (BURP)	Systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address wadeable streams, rivers, lakes, and reservoirs.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are recognized to be the most effective and practical means to control nonpoint source pollutants, yet are compatible with the productive use of the resource to which they are applied.

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Term	Definition
Best professional judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biological integrity	1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).
Clean Water Act	The Federal Pollution Control Act (PL92-500, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (PL100-4), establishes a process for states to develop information on and control the quality of the nation's water resources.
Criteria	Numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.
Designated uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Disturbance	Any event or series of events that disrupt ecosystem, community, or population structure and alter the physical environment.
Duration	The period of time (averaging period) over which the in-stream concentration is averaged for comparison with criteria concentrations.

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Term	Definition
E. coli	Escherichia Coli is a group of bacteria that are a subspecies of coliform bacteria. Most E. coli are essential to the healthy life of all warm-blooded animals, including humans.
Ecological indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological integrity	1) A living system exhibits integrity if, when subjected to disturbance, it sustains and organizes self-correcting ability to recover toward a biomass end-state that is normal for that system. 2) The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living environmental surroundings.
Existing beneficial use or existing use	A beneficial use present in waters on or after November 28, 1975, whether or not the use is designated for those waters in the *Water Quality Standards and Wastewater Treatment Requirements*.
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fixed-location monitoring	Sampling of an environmental or ambient medium for pollutant concentrations at one location continuously or repeatedly.
Frequency	The number of times an event occurs over a fixed time interval.
Fully supporting	In compliance with water quality standards and criteria, and meeting the reference conditions for all designated and existing beneficial uses as determined through the WBAG.
GIS	Geographic Information System, a georeferenced database.

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Term	Definition
Grab sample	A single sample collected at a particular time and place. May represent the composition of the water only at that time and place.
Ground water	The supply of fresh water found beneath the earth's surface.
Habitat	The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.
Hydrologic Unit Code (HUC)	A watershed numbering system developed by the U.S. Geological Survey.
Instantaneous	A concentration of a substance measured at any moment (instant) in time.
Intermittent stream	1) A stream (in contact with the ground water table) that flows only part of the year, such as when the ground water table is high or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years. A stream with a 7Q2 of less than 0.1 cfs is considered intermittent for steady-state waste load allocation modeling. Streams with perennial pools that create aquatic life uses are not intermittent (Idaho Water Quality Standards and Wastewater Treatment Requirements, IDAPA 58.01.02.51).
Lentic	Aquatic system
Lotic	Aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.
Macroinvertebrate	An invertebrate animal (without backbone) large enough to be seen without magnification and retained by a 0.595 mm (U.S.#30) screen.
Magnitude	How much of a pollutant, expressed as a concentration, is allowable.
Metric	One discrete measure of an ecological indicator (e.g., number of distinct taxon).

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Term	Definition
Monitoring	Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.
Natural condition	A condition without human-caused disruptions.
Nonpoint sources	Diffuse pollution sources (i.e., without a single discrete point of origin or not introduced into a receiving stream from a specific outlet). These pollutants are generally carried off the land by storm water. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, and saltwater intrusion.
Not assessed	A concept and an assessment category describing water bodies that have been looked at, but are missing critical information needed to complete an assessment.
Not fully supporting	Not in compliance with water quality standards or criteria, or not meeting reference conditions for each beneficial use as determined through the WBAG.
Nutrient	Any substance assimilated by living things that promotes growth. In water, the term is generally applied to nitrogen and phosphorus, but is also applied to other essential and trace elements and organic carbon.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, pressure, and density are parameters of the atmosphere.
Pathogens	Microorganisms (e.g., bacteria, viruses, or parasites) that can cause disease in humans, animals or plants.
Periphyton	Attached microflora growing on the bottom, or on other submerged substrates, including higher plants. Epilithic periphyton is flora growing on the surface of rock or stones. Diatoms are a type of periphyton.
Physicochemical	In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeably with the term physical/chemical or physiochemical.

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Term	Definition
Point source	A discrete location or fixed facility from which pollutants are discharged; any single identifiable source of pollution.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A concept that encompasses the presence of a substance in the environment that because of its chemical composition or quantity prevents the functioning of natural processes and produces undesirable environmental and health effects as well as the human-made or human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Probability-based sample	A sample selected in such a manner that the probability of being included in the sample is known for every unit on the sampling frame (EPA 2000b).
Professional judgment	Knowledge, experience or other expertise that allows a professional to come to conclusions about an environmental data collection activity that will improve the quality of the data (EPA 2000b).
Protocol	A series of formal steps for conducting a test or survey.
Quality assurance (QA)	A program organized and designed to provide accurate and precise results. Included are selection of proper technical methods, tests, or laboratory procedures; methods of sample collection and preservation; selection of limits; evaluation of data; quality control; and qualifications and training of personnel. Its goal is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).
Quality control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicates. Quality control is implemented at the field or bench level (Rand 1995, EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Random sampling	A probability-based sampling design that protects against selection bias. Specifically, a simple random sample of size n is defined as a sample selected from a population such that all possible samples of n elements have the same chance of being selected (EPA 2000b).

Note: This glossary is intended to define terms within the context of the SWMS. Unless otherwise cited, these working definitions were prepared by DEQ.

Term	Definition
Reconnaissance	An exploratory or preliminary survey of an area.
Reference condition	(1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. (2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and applying expert judgment (Hughes 1995).
Reference site	A specific locality on a water body that is minimally impaired and is representative of the expected ecological integrity of other localities on the same water body or nearby water bodies (EPA 1996).
Representative sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Representativeness	The measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition (EPA 2000b).
River	Large, natural or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.
Sample	A set of units or elements selected from a larger population, typically to be observed for making inferences regarding that population (EPA 2000b).
Sample size	The number of sample units to be collected (EPA 2000b).
Sampling design	A description of the sample collection plan that specifies the number, type, and location (spatial or temporal) of sampling units to be selected for measurement (EPA 2000b).
Sediments	Deposits of fragmented materials from weathered rocks and organic material that are suspended in, transported by, and eventually deposited by water or air.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.

Note: This glossary is intended to define terms within the context of the SWMS. Unless otherwise cited, these working definitions were prepared by DEQ.

Term	Definition
Stream	A natural water course containing flowing water, at least part of the year, together with dissolved and suspended materials, that normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, etc. (Strahler 1957).
Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Surface water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Target population	The set of all units or elements (e.g. barrels of waste or points in time and/or space) about which a sample is intended to produce inferences (EPA 2000b).
Targeted survey	The use of professional judgment to choose sampling locations (EPA 2000b).
TMDL	An acronym that stands for total maximum daily load. A TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, and often incorporates TMDLs for several water bodies and/or pollutants within a given watershed.
Toxic pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Water body	A homogeneous classification that can be assigned to rivers, lakes, estuaries, coastlines, or other water features.
Water quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Note: This glossary is intended to define terms within the context of the SWMS. Unless otherwise cited, these working definitions were prepared by DEQ.

Term	Definition
Water quality criteria	Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water quality standards	State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.
Watershed	The land area that drains into a stream. An area of land that contributes runoff to one specific delivery point; large watersheds may be composed of several smaller "subwatersheds," each of which contributes runoff to different locations that ultimately combine at a common delivery point.
WBID	Water body identification number; a number that identifies a water body, and correlates to Idaho Water Quality Standards and GIS information.
Wetland	An area that is saturated by surface or ground water with vegetation adapted for life under those soil conditions, as swamps, bogs, fens, marshes, and estuaries.

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Appendix A. Integrated Reporting Categories

Based on its assessment and listing methodology, each state or territory should report to EPA the water quality standard attainment status of all AUs in their jurisdiction. Each AU should be placed in only one of the five unique assessment categories. Monitoring needed to support water quality management actions for each AU should be scheduled by year for all categories. Each category and recommended monitoring is described below:

1. **Attaining the water quality standard and no use is threatened**. AUs should be listed in this category if there are data and information that meet the requirements of the state's or territory's assessment and listing methodology and support a determination that the water quality standard is attained and no use is threatened. States and territories should consider scheduling these AUs for future monitoring to determine if the water quality standard continues to be attained.

2. **Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened.** AUs should be listed in this category if there are data and information, which meet the requirements of the state's or territory's assessment and listing methodology, to support a determination that some, but not all, uses are attained and none are threatened. Attainment status of the remaining uses is unknown because there is insufficient or no data or information. Monitoring should be scheduled for these AUs to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information was previously insufficient to make a determination.

3. **Insufficient or no data and information to determine if any designated use is attained**. AUs should be listed in this category where the data or information to support an attainment determination for any use is not available, consistent with the requirements of the state's or territory's assessment and listing methodology. To assess the attainment status of these AUs, the state or territory should obtain supplementary data and information, or schedule monitoring as needed.

4. **Impaired or threatened for one or more designated uses but does not require the development of a TMDL**.

    A. **TMDL has been completed**. AUs should be listed in this subcategory once all TMDL(s) have been developed and approved by EPA that, when implemented, are expected to result in full attainment of the standard. Where more than one pollutant is associated with the impairment of an AU, the AU will remain in Category 5 until all TMDLs for each pollutant have been completed and approved by EPA. Monitoring should be scheduled for these AUs to verify that the water quality standard is met when the water quality management actions needed to achieve all TMDLs are implemented.

B. Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. Consistent with the regulation under 130.7(b)(i),(ii), and (iii), AUs should be listed in this subcategory where other pollution control requirements required by local, state, or federal authority are stringent enough to implement any water quality standard (WQS) applicable to such waters. EPA expects that these requirements must be specifically applicable to the particular water quality problem. Monitoring should be scheduled for these AUs to verify that the water quality standard is attained as expected.

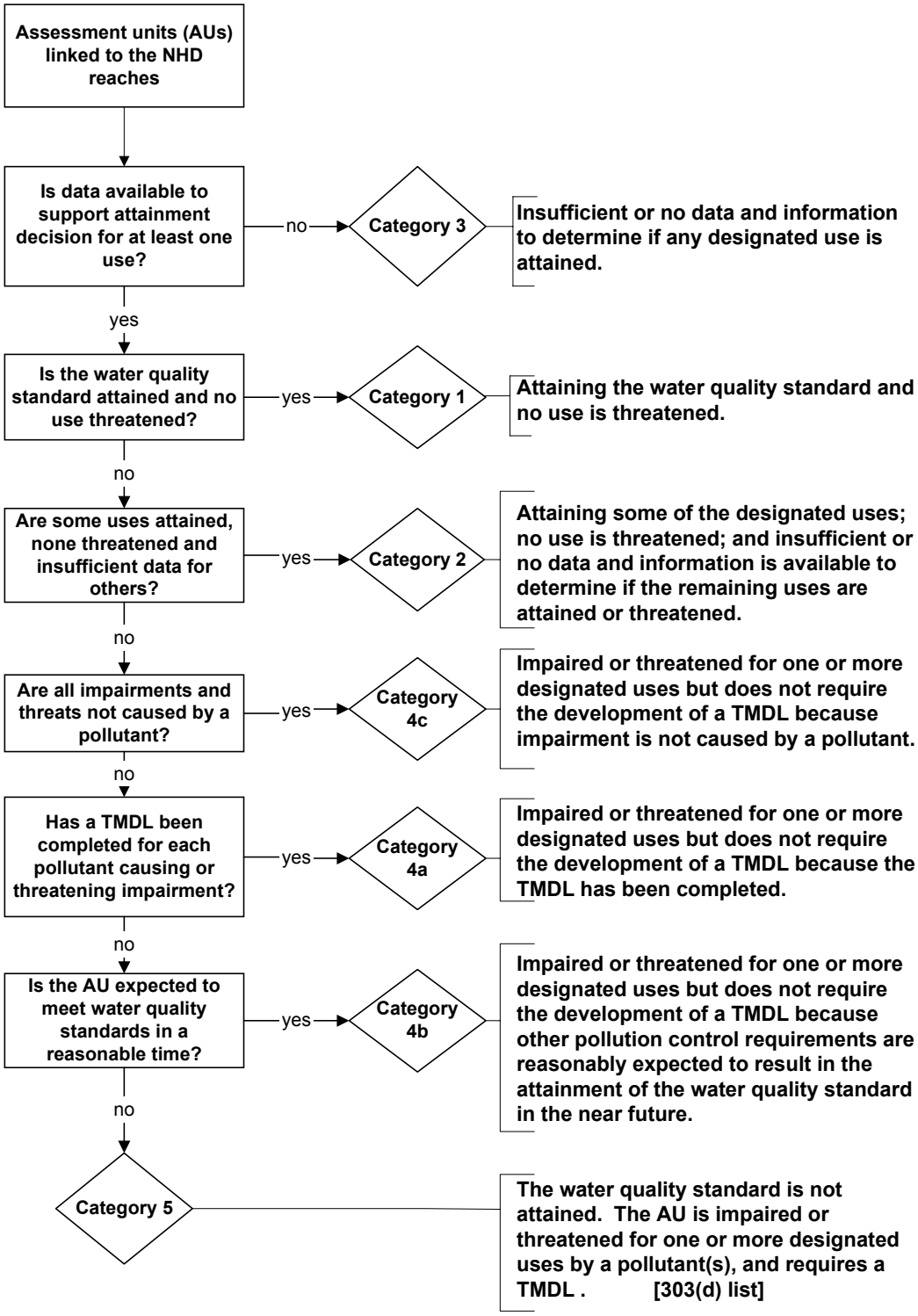
C. **Impairment is not caused by a pollutant**. AUs should be listed in this subcategory if the impairment is not caused by a pollutant. States and territories should consider scheduling these AUs for monitoring to confirm that there continues to be no pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

5. **The water quality standard is not attained. The AU is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL**. This category constitutes the Section 303(d) list of waters impaired or threatened by a pollutant(s) for which one or more TMDL(s) are needed. An AU should be listed in this category if it is determined, in accordance with the state's or territory's assessment and listing methodology, that a pollutant has caused, is suspected of causing, or is projected to cause an impairment. Where more than one pollutant is associated with the impairment of a single AU, the AU will remain in Category 5 until TMDLs for all pollutants have been completed and approved by EPA.

For AUs listed in this category, states or territories should provide monitoring schedules that describe when data and information will be collected to support TMDL establishment and to determine if the standard is attained. EPA recommends that while the state or territory is monitoring the AU for a specific pollutant to develop a TMDL, it also monitor the watershed to assess the attainment status of other uses.

A state or territory must submit a schedule for the establishment of TMDLs for all waters in Category 5. This schedule must reflect the state's or territory's own priority ranking of the listed waters.

Diagram 1. Summary logic used to place assessment units (AUs) into each of the five categories in the *2002 Integrated Report*

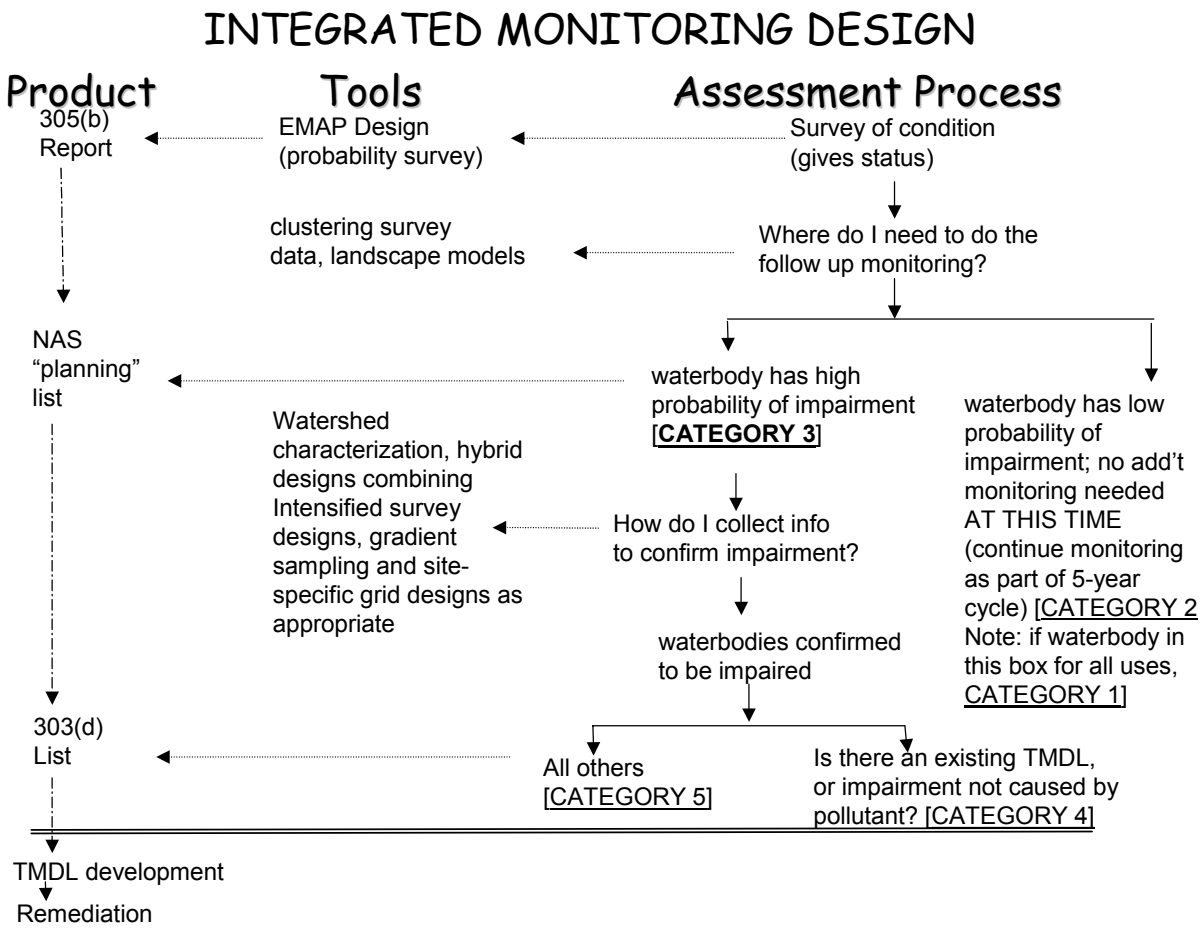


Appendix B. Data Quality Criteria Table (Tier I, II, III)

Description, Examples, and Incorporation of Data Tiers

Tier	Scientific Rigor	Relevance	Example	How Used
I	• Quantitative. • Parameters measured. • Established monitoring plan with QA and defined protocols. • >30 hours of supervised training. • Samples processed in EPA-certified lab following standard methods or by professional taxonomist. • Organisms identified by a professional taxonomist.	• Data relates to either water quality standard(s), especially numeric, or a beneficial use. • ≤5 years old. • Data relates to a named water body (GIS, latitude and longitude or map location provided).	• Ph.D. or masters thesis. • Published or printed studies or reports. • Published predictive models. • EPA EMAP. • BURP data. • Use attainability analyses. • Rapid Bioassessment Protocols (RBP).	• 303(d) listing or de-listing. • 305(b) reports • subbasin assessments. • TMDLs. • Planning for future monitoring.
II	• Qualitative or semi-quantitative in nature. • May have a monitoring plan. • No QA/QC provided for within plan. • Protocols may or may not be defined. • Parameters rated. • Field staff may not be trained: Lab may not be certified. • Taxonomist may not be a professional.	• Data may relate to a watershed. • Not water body specific. • Data >5 years old. • Data may relate to other agency guidelines or objectives.	• Environmental assessments. • Proper Functioning Condition. • Cumulative Watershed Effects. • Most citizen monitoring. • Models with documentation. • Agency planning documents.	• 305(b) reports. • Subbasin assessments or TMDLs when data adds to overall assessment quality. • Planning for future monitoring.
III	• May be qualitative in nature. • Parameters evaluated. • Field staff have little to no training. • No documented monitoring plan. • No QA/QC. • Anecdotal in nature.	• Not specific to water quality standards or beneficial uses. • Location not specific. • Data ≥10 years old.	• Non-specific reports or studies. • Newspaper articles. • Simple models without any documentation.	• Planning for future monitoring. • Hold for further investigations.

Appendix C. Integrated Monitoring Design (EPA)



Appendix D. 5-Year Monitoring Plan Example

	Year 1 # of Sites	Year 2 # of Sites	Year 3 # of Sites	Year 4 # of Sites	Year 5 # of Sites	Total # of Sites
Screening Surveys	300	285	150			735
Reference Trend	25	25	25	25	25	125
Repeat Sampling	30	29	15			74
Rivers		40		40		80
Lakes/Reservoirs	55		55		55	165
Targeted Surveys			159	307	306	772
Total Sites	410	379	404	372	386	1951

Per Sample Costs

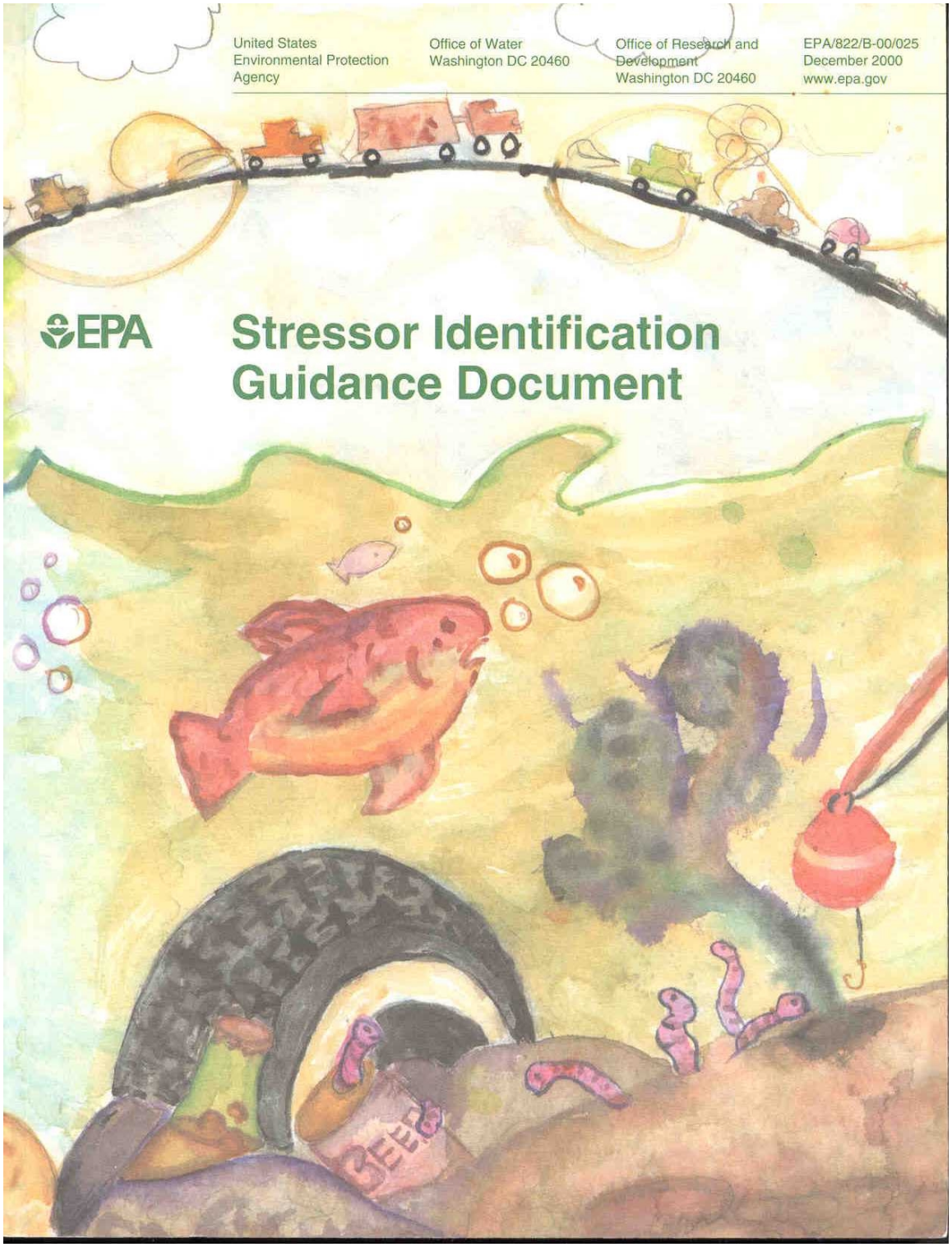
No lakes*	$630	$662	$695	$729	$766
Lakes only*	$300	$315	$331	$347	$365

Total Monitoring Costs

Sample Cost Subtotal (no lakes)*	$223,650	$250,378	$242,407	$271,301	$253,470
Sample Cost Subtotal (lakes only)*	$16,500		$18,191		$20,056
Crew Cost Subtotal**	$259,000	$264,180	$269,464	$274,583	$288,596
Total Cost	**$499,150**	**$514,588**	**$530,062**	**$546,154**	**$562,121**
BURP Resources* **	**$500,000**	**$515,000**	**$530,450**	**$546,364**	**$562,754**

Note: *Assumes 5% increase in sample costs. **Assumes 2% increase in labor costs. ***Assumes 3% increase in BURP resources.

Appendix E. Stressor Identification Document



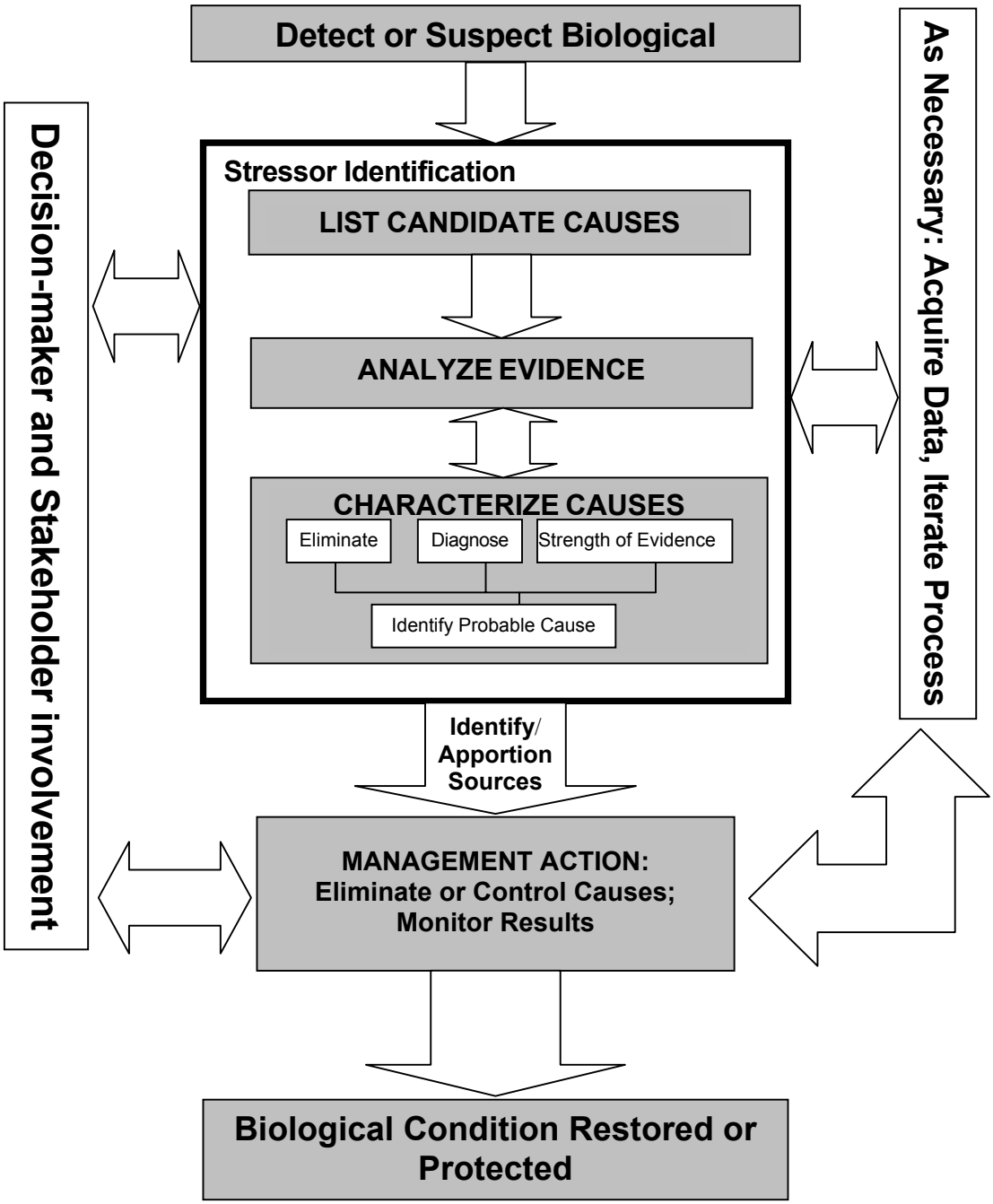


Figure 10. The management context of the SI process.
(The SI process is shown in the center box with bold line. SI is initiated with the detection of a biological impairment. Decision-maker and stakeholder involvement is particularly important in defining the scope of the investigation and listing candidate causes. Data can be acquired at any time during the process. The accurate characterization of the probable cause allows managers to identify appropriate management action to restore or protect biological conditions.)